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AMERICAN INDUSTRIES—No. 83.

HARVESTING AND THRESHING MACHINERY.

The great prominence achieved by representatives of the Buckeye State in national affairs during recent years is a notable fact, and it may safely be added that the manufacturing interests of the State of Ohio give an eminence in the industrial field equal to that accorded to her by the sisterhood of States in national politics. We have chosen one of the most extensive and successful of these manufactories as the subject for illustration. The well known incorporated company, C. Aultman & Co., of Canton, Ohio, have among their products Buckeye harvesting machines, threshing machines, and portable engines, horse powers, and all the attachments and equipments required to place their machines in the field fully fitted for instant and effective service. No single manufactory in America produces such an array of labor-saving farm machines. These various machines constitute the most efficient equipment yet designed by human skill to aid the farmer in the several processes by which he fits the ripened grain in the field for market. In these extensive works are found a very large number of wood and metal workers, busily engaged, day and night, by steam and hand power, using the swiftest and most exact methods in shaping and fitting crude materials and converting them into the various parts of the grass and grain saving machines that have in late years revolutionized the operations of agriculture. The mowers and reapers constructed previous to 1857, having only one driving wheel and a rigid cutter bar, were of a very limited capacity and utility, and the introduction of two driving wheels and a double hinged, pliable bar marked a new era, popularized these machines, and gave to their manufacture a most powerful impulse.

The radical improvements to which we refer were invented by Messrs. C. Aultman & Co., of Canton, Ohio, and the

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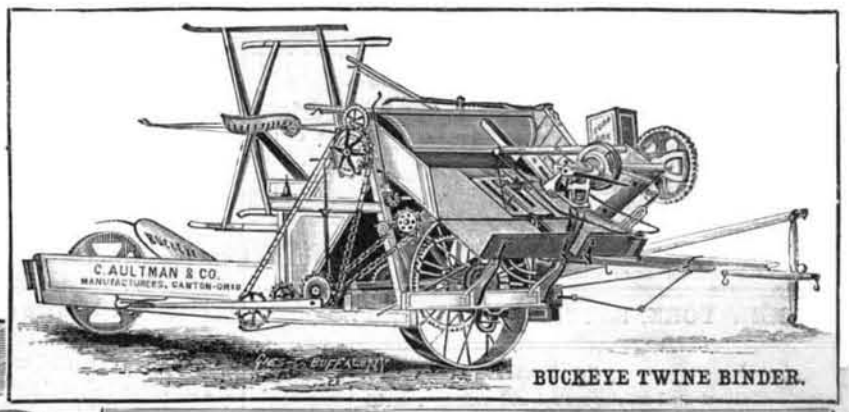

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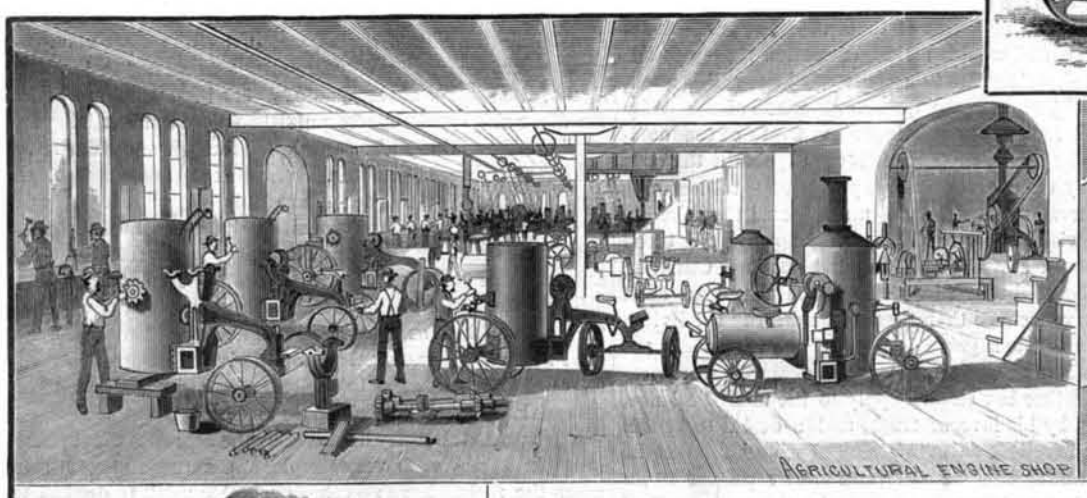
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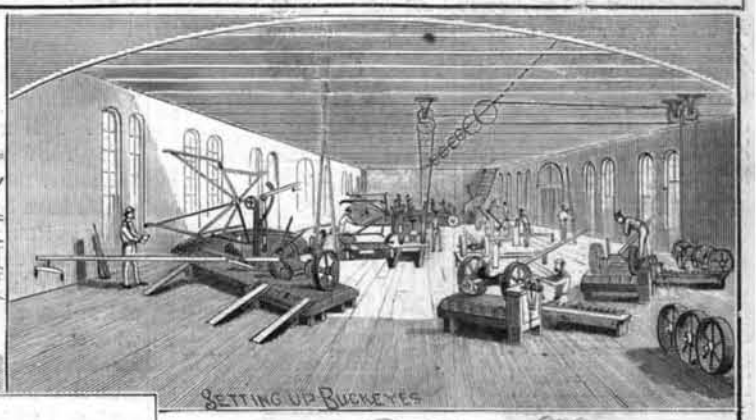
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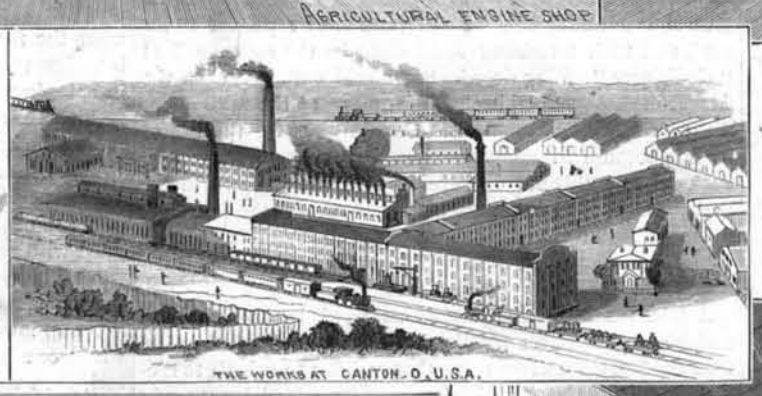
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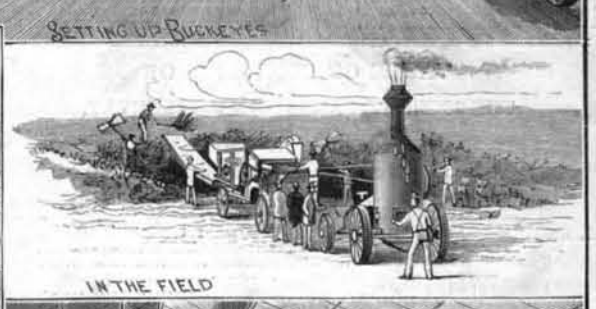
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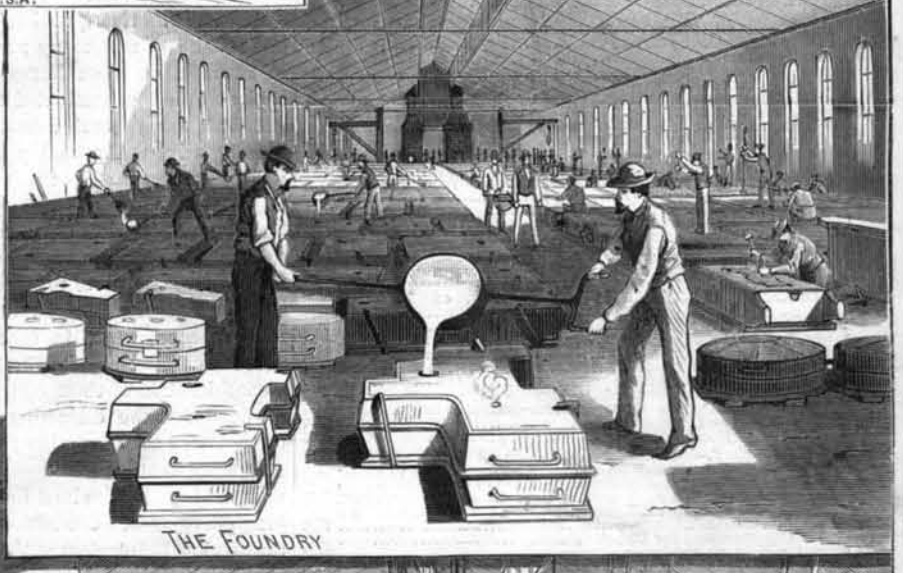
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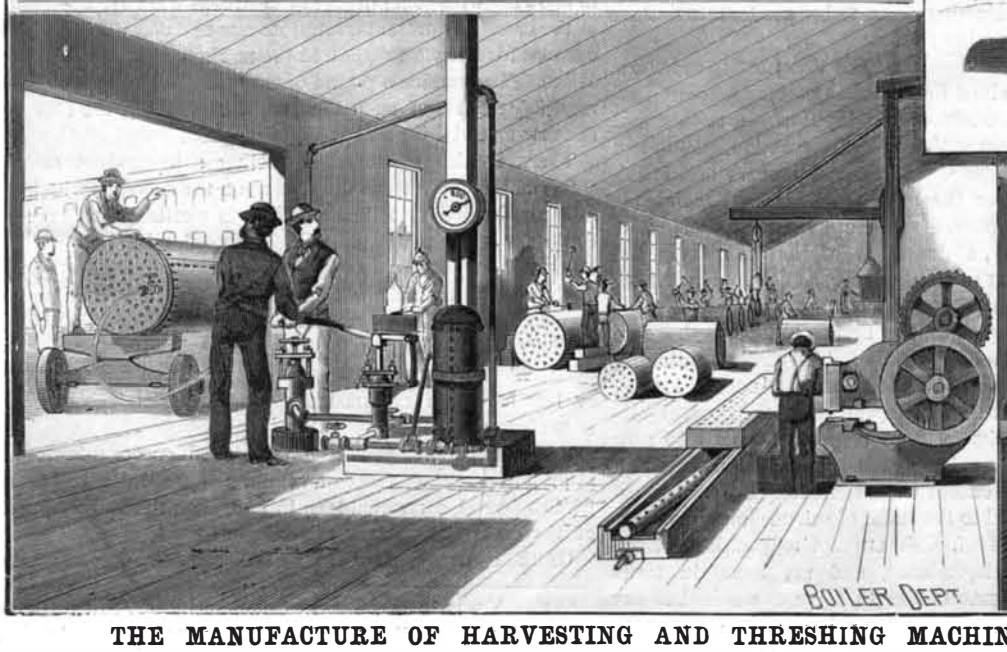
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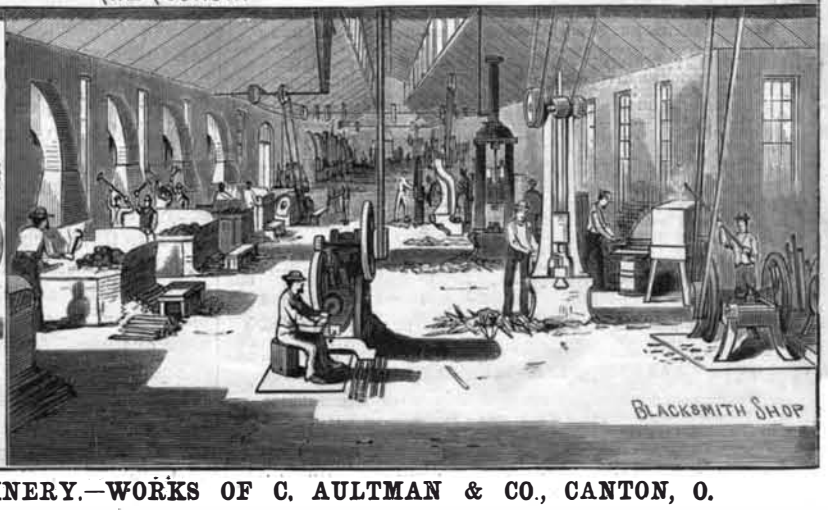
BLACKSMITH SHOP.

THE MANUFACTURE OF HARVESTING AND THRESHING MACHINERY.—WORKS OF C. AULTMAN & CO., CANTON, O.

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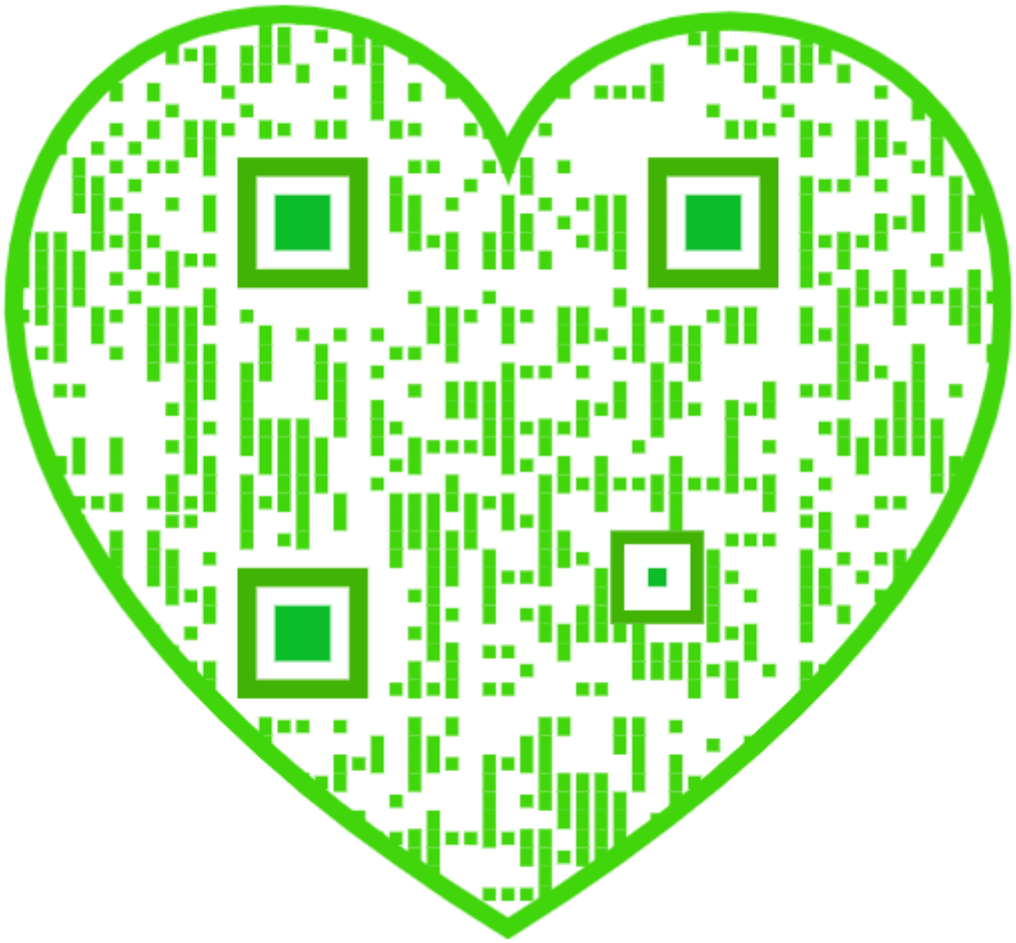

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VIVISECTION AND MORTISECTION.

The pursuit of knowledge under difficulties has, from time immemorial, furnished a fruitful subject for the moralist, the philosopher, and the humorist. Perhaps danger gives zest to certain pursuits which would otherwise want for disciples. The cold and privation which constitute the risks to be incurred in Arctic explorations have, for certain people, the same irresistible power of attraction that lend a charm to the dangers of tropical Africa, and lead thither those brave men who take a real pleasure in advancing the boundaries of knowledge.

The difficulties encountered by explorers in barbarous countries are scarcely less than those to be overcome in civilized communities, owing to the prejudice of the populace and ignorance of the law givers. As man himself stands at the head of animate creation the last and crowning glory of the Creator's handiwork, the study of man becomes the noblest of studies. A selfish spirit prompts us to seek our own physical welfare, and, admitting the principle of self-defense as the first law of our nature, no branch of science deserves greater attention nor should excite greater interest among all men than anatomy. A knowledge of the machine is absolutely essential to those who would repair it.

In early times when life was held in small regard it was not considered so very wrong to sacrifice a human being to appease some angry god or ward off a threatened plague or pestilence. To carve a lifeless corpse in order to prepare it for the roasting spit, or to obtain the entrails for the altar, was no uncommon deed, and yet up to the beginning of the fourteenth century we read of no case where a dead body was publicly dissected for the purpose of learning how it was made, its parts and their offices. The Mohammedan religion still forbids the dissection of a human body, and the people of to-day, nine-tenths of them at least, are Mohammedans at heart and would forbid dissection if they could.

The recent shooting case in a graveyard has called attention to this subject, and the question is asked afresh, Why must men risk their lives and incur the wrath of the community and the scorn of their fellows to obtain the only means whereby the surgeon and the physician shall learn his duty? Is it because the dead are more sacred than the living? The Jewish law required that he who shed the blood of another should suffer a like fate; but modern Christian people have decreed that those who touch the dead shall suffer swifter vengeance than those who destroy the living. Those who desecrate a grave in hope of extorting from the bereaved relatives an exorbitant ransom deserve severe penalties; but another law should apply to the man of science, who, actuated by his love of truth, and a desire to benefit mankind and to relieve suffering humanity, goes forth at the grim hour of midnight upon an errand most repulsive to his soul, and with trembling hand disturbs the sacred soil of "God's acre." Why does he brave cold and wet, even the danger of shot gun or pistol, and, at a loss of time and sleep, disturb the ashes of the dead? Certainly not for the fun of it; but because in many sections of the country law and custom make this his only resource. The same legislator that would make a dissection a *sine qua non* for the degree of doctor, would render dissection impossible by giving him no subjects except those obtained from graveyards, and then making body snatching a capital offense.

A false sentimentality makes us unwilling to see the remains of our relatives mutilated, yet many of our leading men confess themselves more than willing to submit to cremation. Here the question of premature burial naturally presents itself, and many persons say they should prefer to be burned alive than buried alive. It seems rather a sad choice! Well authenticated cases of burial alive are known; and with the general introduction of cremation cases of burning alive will probably take place, although then there will be no means of proving it, for the involuntary motion of the limbs in the furnace is no proof of life. While burning and burying alive are both possible, it is safe to say that no one ever has been, or ever will be, dissected alive, for the first stroke of the scalpel would detect the faintest spark of lingering life. In fact, cases are reported where this has happened, while in other cases body snatchers have proved rescuing angels who have saved human life. From a consideration of these facts the unprejudiced mind would acknowledge the dissecting room to be a safer refuge than the grave or the cremation furnace.

In the meantime this does not settle the question as to how material is to be obtained for dissecting-rooms without robbing graveyards. Cremation would put a stop to this, and thus seriously interfere with medical instruction. It is not enough that some States give their dead paupers and criminals to the colleges, for the number of medical colleges is greater than the number of the subjects thus obtainable. But there is one way, at least, out of the difficulty. Let every medical student solemnly swear, as he stands with uplifted scalpel before his first subject, that in return for the privilege of dissecting others he agrees to give up his own body after death for a like purpose. The medical fraternity owe it to their successors to form a mutual dissecting league, and thus render themselves independent of the general public, and at the same time win the respect of those who now blame them for encouraging grave robbing, an offense that none of them defend except when absolutely necessary.

Equally detrimental to the cause of science and the interests of humanity is the foolish attempt to prohibit vivisection. Theology, jurisprudence, and art have, in times passed, subjected human beings to tortures worse than any vivisector ever inflicts upon dumb animals. In the name of religion, of justice, and of art, vivisection has been practiced on man, but it is now denied to the student of anatomy, of physiology, and of pathology. Is "the true" of less consequence than "the good," "the right," and "the beautiful?" Trade and commerce, fashion and dress, epicureanism and gormandism, as well as art and industry, inflict upon our harmless neighbors of fur and feather woes greater in number, more severe in character, than the scientific investigator visits upon the animals subjected to his knife. The huntsman that leaves his dying prey in the bush, the taxidermist that flays a trembling bird for my lady's bonnet, the purveyor who stuffs the Strassburg goose until his liver is hypertrophied, and mutilates animals of all kinds to tickle my lord's palate—are they not guilty of acts as cruel and less defensible than the vivisector's? But we forbear to multiply examples. The case of the Dutch society for the prevention of cruelty to animals, which secured the passage of an act prohibiting the harnessing of dogs and compelled the women to drag their canal boats alone, is but an example of the way these self-styled humanitarians work.

HOW SILK IS REELED IN FRANCE.

To the Editor of the Scientific American:

I was glad to see in the SCIENTIFIC AMERICAN of March 4 a correction of an exaggerated estimate of the profits of silk culture, which had been copied from another paper into one of the numbers for February. The figures given in the article published in the number of March 4 are in general correct, and, it seems to me, are quite encouraging enough to induce people who are so situated as to carry on sericulture to advantage to enter into it.

Those who are best informed on the subject feel that the time has arrived when this industry may properly be introduced into the United States, and that with proper management it may be made a very important matter. A hopeful sign of the progress being made is, that there seems to be in the discussions and reports published about silk raising an absence of anything like speculative feeling, and a desire to obtain and disseminate reliable and exact information. I hope, therefore, that you will kindly permit me to call attention to an important branch of the subject, concerning which the article in the number of your paper referred to is not very clear, nor sufficiently accurate. I mean reeling.

The statement that "skillful reeling doubles the value of the cocoons" has, as I find by correspondence, been made use of at home in a manner calculated to give rise to false impressions, and in some cases to excite hopes which are sure to be disappointed when brought to a practical test.

It is true that silk may be reeled by the raisers of the cocoons in their homes with very simple apparatus, and at times when the reelers have no other profitable work to do, but it is no less true that these people might also employ such time in spinning, weaving cloth for their household use, in making their own boots and shoes, or in carrying on any of those industries which were formerly domestic matters, but which, because of a better organization of manufacture, it is at present infinitely more economical to prosecute in large establishments especially organized for the work, and supplied with proper machinery and appliances.

It requires very much less skill to weave cloth or to make shoes than to reel silk properly, and I think that a woman of average intelligence and address would find a spinning wheel or a hand loom a much better investment than a silk reel, even were she provided with cocoons.

Every one is aware that the spinning wheel and domestic loom have disappeared, and I presume that a proposal to return to their use as a means of employing the unoccupied time of American women of the middle rural classes would be looked upon as simply fantastic and absurd.

That the idea of reeling silk by the raisers of the cocoons is not regarded at home in the same light is simply because of want of information.

In Europe large and well organized filatures for silk have displaced domestic reeling to at least as great an extent as cotton, woolen, and linen factories have superseded the domestic production of cloth.

The following figures concerning silk reeling may be relied upon as accurate, and I trust will be found of service in showing with some degree of clearness what are the facts in the case. At present quotations a pound of yellow French cocoons (dry) is worth $1.20 in the markets of Marseilles and Milan. To produce a pound of raw silk requires on an average $3\frac{6}{10}$ pounds of such cocoons, thus making the cost of the raw material for a pound of silk $4.32.

There is also produced in reeling a by-product called "frison," coming from the silk upon the cocoons, which is not transformed into thread. This is worth about seventy cents for each pound of silk produced. Deducting this amount from the total cost of cocoons, there remains $3.62 as the cost of the silk in the cocoons, which is to be transformed into a pound of raw silk.

The value of the pound of raw silk, when produced, depends very largely upon the skill of the reeler, and the more or less favorable circumstances under which the reeling is performed.

Badly reeled silk, produced from good cocoons, is worth at present about 40 francs a kilo, or, say, a little less than $3.40 a pound, somewhat less, in fact, than the market price of the cocoons necessary to produce it.*

On the contrary, silk produced by the best filatures, and

* This silk is probably quite as well reeled as it would be if produced by American women working in an irregular way in their own homes.

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exceptionally well reeled, sells for from 68 to 70 francs a kilo; say, on an average of present prices, $6 a pound. In point of fact, it has become impossible for women to gain anything by reeling at home.

Those of the country women whose necessities compel them to become reelers, and who possess the requisite skill, are obliged to become employees in large filatures.

These establishments are usually in country districts, and the workwomen, besides working from twelve to fourteen hours a day, often walk long distances to and from the filature. As a recompense for a long day's labor, for the skill which it has required years of practice to obtain, and for a labor which requires unremitting attention, a cramped and never changing position, confinement in an atmosphere impregnated with steam and acrid vapors, and the constant dipping of the hands in scalding water to an extent which often produces special diseases, they receive very poor pay.

In France the average pay of a reeler is from twenty to twenty-eight cents a day, according to the locality and the degree of skill which she may possess.

In Italy women are paid from twelve cents (for basseuses) to nineteen cents a day for the best reelers.

It must be understood that for this pittance the women are obliged to feed themselves and provide for all their wants.

Even while paying these frightfully low wages, a filature can only be made profitable by the exercise of constant supervision and care, and the uniform production of a really good article.

The reason is that it requires so much work to reel so little silk.

Up to within a very short time it has been considered quite impossible to regulate the reeling mechanically, and although the details of the filature have been much improved, enough so as to render competition by the old fashioned hand reels out of the question, the principle has always remained the same, and it is still necessary for a skillful woman to *watch* the unreeling of nearly 1,500 miles of cocoon filament for each pound of silk obtained.

This, as has become well established, is the reason why silk culture and reeling have never been successful in America, and every one possessed of the least humanity must hope that the day is far distant when it will be possible to compel any one in our country to do so much work for so little pay.

I do not claim the merit of any originality or remarkable insight in this matter. The facts above stated are thoroughly well known and familiar to all who have properly investigated the matter.

As has become well known, the question of raising silk in our country is reduced to a question of the possible invention of machinery for transforming the raw material (cocoons) into a merchantable and useful product (raw silk), and attention has often been called to the analogy of the case to that of cotton raising at the time of the invention of the cotton gin.

I am greatly in hopes that the automatic silk reel of Mr. Serrell is destined to solve this important question for us, as the Whitney cotton gin solved the question of cotton raising.

The automatic reel is just now creating a great deal of excitement even in Southern France and Italy, countries which are possessed of very cheap and skillful labor, and much afflicted by the spirit of routine. Should it prove as successful as it bids fair to do, there will be no question of the success of silk raising in America, but unless either it or some similar invention can be made to answer, silk culture in America must be abandoned or so organized as to permit of the exportation of cocoons.

I have had much pleasure in aiding to arrange for the sending to America of some of these machines as an experiment, and am sure that were the importance of the affair properly understood, everybody would share my anxiety as to the result.

Please pardon this demand upon your attention. I am sure that the spirit which has always been manifested in your paper will cause you to agree with me in the feeling that every means should be taken to present clearly all matters relating to a new industry in our country which must be undertaken by people too little organized, too scattered, and too remote to collect the information for themselves.

F. C. PEIXOTTO.

Lyons, France, April 25, 1882.

CRYSTALLINE GLASS.

BY J. B. MILLER.

If plate glass is painted over with any water color and then exposed to cold, so that the water freezes, it will, of course, form ice crystals. If slowly dried at a moderate temperature they do not disappear, and the structure retains the ice-like forms. If the pigment used was one of the fusible oxides used in coloring glass, no matter what its color, the crystalline structure can be fixed on the glass by burning it in.

Many salts act in a similar manner when their solutions are mixed with the glass pigments, and form different figures, according to their manner of crystallizing. Aside from their decorative effects for table tops, frames, etc., which produce a fine appearance when gilded or silvered, the crystalline forms fixed by burning in these fusible pigments would form interesting collections and serve as helps in scientific lectures.

By the use of hydrofluoric acid (the acid from fluorspar), too, very beautiful crystalline forms may be produced which are very similar to the ice pictures on our windows in winter.

According to E. Siegwart, of Schweizerhall, near Basel, strontianite (carbonate of strontia) is dissolved in hydrochloric acid diluted with an equal volume of water as long as it dissolves any, and then evaporated to a pasty consistency. When cold this substance, chloride of strontium, is dissolved in alcohol, by stirring, and the clear filtered liquid poured upon a well cleaned plate of glass, which is left lying in a horizontal position until the crystallization is completed, which, as already stated, forms very pretty shapes, which are deceptively similar to ice flowers, but wash or rub off easily from the glass. In order to fix them they are exposed to the vapors of hydrofluoric acid. Wherever this comes into contact with the chloride of strontium it forms fluoride of strontium, which protects the spots where the glass is covered with it, and hence acts as an etching ground. The unprotected portions of the glass are rendered matte by the vapors of the acid.

To protect the reverse side of the glass from being attacked it must be protected by a greasy substance able to resist the action of the hydrofluoric acid, a thickened varnish being the best for the purpose. An even layer of it should be spread over the back of the glass and allowed to dry before the chloride of strontium solution is poured on the right side of it.

The etching with hydrofluoric acid must be performed with proper precaution; it is, however, perfectly harmless, and scarcely disagreeable if done in the following manner, which I will describe somewhat in detail, for in recent times this means of engraving is often employed, sometimes for ornamentation, sometimes for printing from, and, so far as I know, there are no satisfactory directions in existence.

The etching is done in a box closed all around, which is best made as follows:

Six boards of dry wood well fitted together are made into a box, which is 32 inches high, 28 inches deep, and 22 inches wide, inside measurement. Around it, let into the wood, are slats fastened with wooden pegs, so as form a rectangle within, with the broad surfaces outward, so that when the boards are slid in through the groove they form and make a box of that size. Two angle irons are screwed on each side towards the front of the box to receive a rod to fasten the front boards that form a door.

All the wooden wall as well as the boards that slide is to be protected against the action of the hydrofluoric acid by repeatedly warming and impregnating thoroughly with tar. It can easily be lined with sheet lead one twenty-fifth of an inch thick. The sides of the box will be previously roughened with pumice, and the lead glued on.

All the parts are smooth except the roof, which rises a little in the middle, sloping toward the sides. In putting it together the joints between the boards are smeared with soft cement of red-lead, and separate portions fastened securely together with wood screws that go all the way into the wood. The front is left open, and is not closed till after the plates of glass are put in, when it is closed with these boards, which are also cemented on the edges. By putting in wedges behind the rods these boards can be wedged up against the cleats so as to close it hermetically.

A leaden dish just as large as the bottom of the box, and 1½ inches deep, can be made from a sheet of lead, and is cemented to the sides of the box so that it will catch the acid that condenses and runs down the side of the box, and the dish is therefore filled to a depth of one-quarter or one-half inch with distilled water. On one side, and just above the dish, the tube from the gas generator enters and extends to the middle of the box. Near the top of the box is another lead pipe that leads to a chimney with a good draught. Both pipes must fit air-tight, and be cemented besides.

A wooden support about 6 inches high, also saturated with tar, is provided with two cross sticks, in which are V-shaped cuts about an inch apart to receive the plates of glass. Such a box will hold thirty plates of glass 20 to 24 inches in size, which rest in these cuts below, and are held perfectly vertical by means of blocks of wood an inch thick at the top.

The gas generator stands by the side of the box, and consists of a pear-shaped leaden retort, or a leaden bottle cut down, and provided with a funnel-shaped cap well fitted and cemented on, its prolongation acting as delivery tube.

All cracks and chinks must be carefully greased and covered with a piece of bladder. The delivery tube must be cooled as much as possible. If it can be laid in a trough of cold water, that is preferable to covering it with wet cloths.

It is always well to have some rye paste ready to stop up any spot where gas escapes, without delay.

After the box has been filled with glass plates to be etched, and closed, the gas generator is filled half full of a pasty mixture, consisting of one part of pure finely pulverized fluorspar, and three parts of concentrated sulphuric acid. The gas is evolved by the application of a gentle heat, preferably that of a water bath in which the retort is suspended and which is kept quietly boiling.

As soon as vapors of hydrofluoric acid begin to be given off, the etching commences, and in ten or fifteen minutes is completed. The fire is then withdrawn, and cold water poured over the retort, and this continued until it is perfectly cold. The retort is then thrown into a vessel full of cold water, whereby it is rendered harmless. The vapors in the box are expelled by blowing air in with a bellows. The glass may then be removed, but the hands must be protected by rubbing grease over them or with India rubber gloves. The acid that accumulates in the leaden box can be preserved in a gutta percha bottle. The plates of glass are dipped in a tub of water; then the ground varnish on the back is softened with warm petroleum, and rubbed off with dry bran, and then the whole glass is washed with warm lye and rinsed in warm water.—*Neueste Erfindungen*, No. 5.

A NEW SILVERING PROCESS FOR IRON AND STEEL.

De Villiers has invented a metallic alloy for silvering. It consists of 80 parts of tin, 18 parts of lead, and 2 parts of silver, or 90 parts of tin, 9 parts of lead, and 1 part of silver.

The tin is melted first, and when the bath is of a brilliant white the lead is added in grains, and the mixture stirred with a stick of pine wood, the partially melted silver is added, and the mixture stirred again. The fire is then increased for a little while, until the surface of the bath assumes a light yellow color, when it is thoroughly stirred up and the alloy cast in bars.

Whenever there is a choice between iron and steel, in making any article, the best quality of steel is to be preferred. The operation is then carried out in the following manner:

The article, a knife blade for example, is dipped in a solution of hydrochloric or sulphuric acid (from 1 to 10 parts of acid in 100 parts of water). After taking it out of this pickle it is immediately rinsed with clean water, then dried and rubbed with a piece of soft leather or dry sponge, and finally exposed to a heat of 70° or 80° C. (158° to 176° Fahr.), for five minutes in a muffle. The object of this is to prepare the iron or steel to receive the alloy, by making the surface porous or covered with small microscopic holes. If the iron is not very good these holes are much larger, and frequently flaws and bad places are disclosed, which make the silvering more difficult. With steel the process goes on very regularly.

The article is warmed to 122° or 140° Fahr., and dipped in the bath of the above described alloy, which is melted by a gentle fire of graphite or refractory clay. The bath must be perfectly fluid, and is stirred with a stick of pine or poplar; the surface of the bath must have a fine white silver color. Under these circumstances the object thus prepared quickly takes up the alloy, which penetrates the porous surface. For a knife blade an immersion of one or two minutes is sufficient to cover it; larger articles require five minutes' immersion. After taking it out of the bath it is dipped in cold water, or treated in such a way as to temper it, if tempering is necessary. If it is left too long in cold water it frequently becomes brittle, but this evil can be avoided by a little experience. It is then only necessary to rub it off dry and polish without heating it.

Articles treated in this manner look like silver, and ring like it too, and withstand the oxidizing action of the air. To protect them from the effect of acid liquids like vinegar, they are dipped in a bath of amalgam, composed of 60 parts mercury, 39 parts of tin, and 1 part of silver. It is then dipped warm into melted silver, or electro-plated with silver to give it the silvery look. The method of polishing will depend on the shape of the object. This kind of silvering is said to be very durable, and even resist gentle filing. The cost of the process is comparatively small. If this method is as good as the inventor represents it in the *Machine Builder*, this kind of plating will be preferred to nickel plating.

P. N.

TEMPERATURE OF STEAM AND WATER AS AFFECTED BY PRESSURE.

To the Editor of the Scientific American:

Your correspondent, Wm. Ord, in your No. 19, under the caption of "The Recent Lawson Boiler Experiment," expresses a doubt which is very widespread in the minds of people who think they know something about steam, whether water can exist "as water" (so he puts it) at a temperature of 400° F. It is not generally understood that "water boils" and forms steam at 212°, only under atmospheric pressure, say 15 pounds per square inch; that at one half the pressure of the atmosphere it boils at 180°; at one third atmospheric pressure (5 lb.) water boils at 162°; while at a pressure of 220 lb. above atmosphere it requires a temperature of 392°; and at 300 lb. pressure it requires 422°.

The temperature of the water is the same as that of the steam inclosed in the same vessel, and the fact of what portion remains "as water" is determined (so long as heat continues to be applied) by the capacity of the vessel, the volume of a cubic foot of water in steam of 220 lb. pressure being 121 cubic feet; so that, as an example: given a boiler having 500 cubic feet capacity and containing 333⅓ cubic feet of water, and raised to a temperature of 392°, the water by its expansion "as water" would be increased in volume to 380 cubic feet, of which one cubic foot, counted into steam of 392° temperature, and therefore of 220 lb. pressure, would occupy 121 cubic feet, leaving 379 cubic feet to be occupied by water "as water."

The querist and his co-doubters can learn much about the qualities of steam by consulting "A Practical Treatise on Heat," by Thomas Box.

W. P. S.

New York, May 18, 1882.

A Year's Immigration in a Month.

On the last day of May eight steamers landed at Castle Garden 5,995 immigrants, the largest number ever received in one day. Among them were sixty silk weavers from Marseilles, and over a hundred millers from Hamburg. The total arrivals for May, 90,019, outnumbered those of the entire year of 1876 or of 1878.

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HARVESTING AND THRESHING MACHINERY.

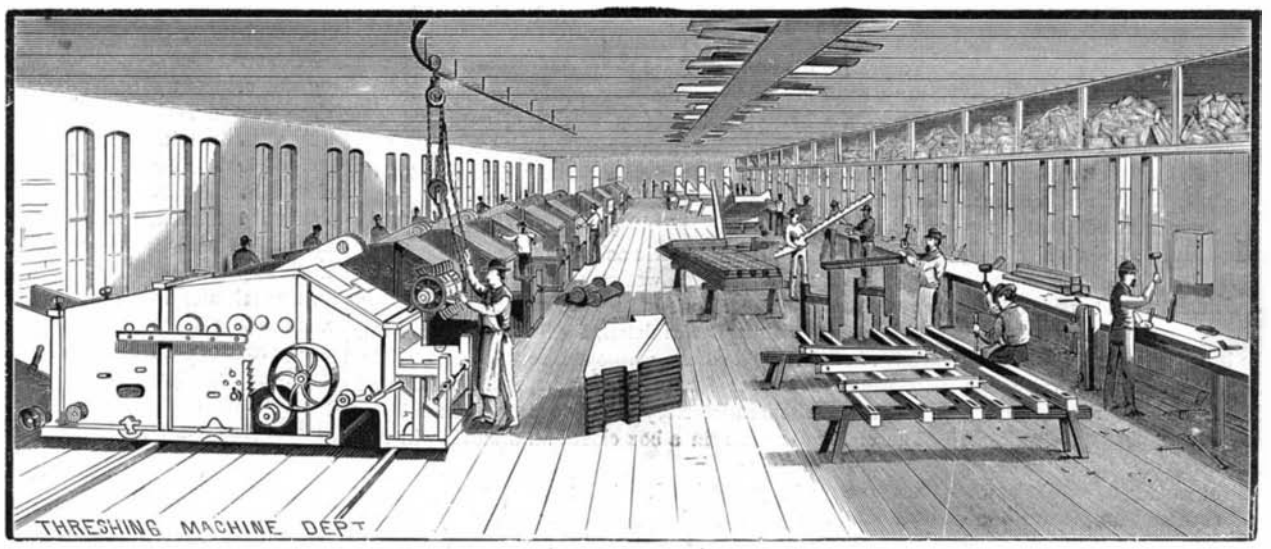
[*Continued from first page.*]

machine to which they were applied was called the "Buckeye." The Buckeye was first exhibited to the world at a trial of machines held at Syracuse, N. Y., in 1857, under the auspices of the United States Agricultural Society.

All the manufactories of any consequence in the country were represented. All the machines present had the single wheel and stiff bar. Only the Buckeye moved on two wheels and had the flexible bar. To the latter was awarded the gold medal and all the honors and commendations that it was in the power of the awarding committee to bestow.

From that day to this all farmers have exacted, and all manufacturers have been *compelled* to supply, machines patterned after the model first made by C. Aultman & Co., and shown by them at Syracuse.

As early as 1863 the Buckeye interest had assumed such proportions that it was deemed best to establish another manufactory at Akron, some twenty miles north of Canton, and to divide the selling territory between the two establishments. The management of the Akron branch has been so vigorous and agressive that, coupled with the excellent territory which fell to its share, including some of the rapidly developing States of the great West, it bids fair before many years to rival the parent house in the volume of its business.



WORKS OF C. AULTMAN & CO.

The superintendent of works at Canton is Mr. Jacob Miller, who has for many years occupied this responsible position. The president of the board of directors is Mr. Lewis Miller, of Akron, who is also superintendent of the Buckeye Works at Akron. It will interest our readers to know that these brothers, who in their youth had a distinguished part in the invention of the Buckeye, still retain actual control of its vast manufacturing interests. Mr. Henry C. Fogle, the secretary and treasurer of the house, has had the management of its financial affairs for the last eight years, during which its business has been not only most successful, but very largely extended. Mr. Cornelius Aultman, who was prominently identified with the business in the beginning and for a number of years thereafter, and from whom the corporation takes its name, still resides in Canton. He is largely interested in the works, but has not actively participated in the business for some years. It thus appears that the genius which designed and contrived an implement of such enormous importance as the reaper of the present day has reaped a suitable reward.

No single fact better illustrates at once the standard character of these machines and the continuous development of our agricultural interests than the history of such a house. Some persons have supposed that in view of the tens of thousands of these machines issued from year to year the wants of the farmers would by-and-by be measurably supplied, and that the demand would be comparatively diminished.

The contrary, however, is true. Year after year, with rarely an exception, additional room is required and new facilities are brought into requisition. Invention and experiment, in the effort to place the greatest results within the scope of the farmer, are constantly adding and improving. The latest addition, and one that promises to outstrip every other labor-saving farm machine in utility and popularity, is the Buckeye twine self-binder. This machine is drawn by three horses and operated by one person, cutting, raking, and securely binding with twine from fifteen to twenty acres of grain daily, and doing the work far more neatly, whether the grain is standing or tangled, than it can be done by any other process. With such a machine nearly all the expense and drudgery of harvest are spared to the farmer and his wife. Agriculture can scarcely ask invention to go a step further. This machine differs from all other binding machines in essential particulars, and many of its more important features are secured to the company by their own or by acquired patents.

In the manufacture of threshing machines and portable engines Messrs. C. Aultman & Co. have gained unrivaled distinction. The thresher made by C. Aultman & Co., named the "New Model," heads the list of machines of that class, having as special merits solidity, very large capacity, and thorough separation. During thirty years the demand made upon C. Aultman & Co. for this class of machines has been increasing from year to year. Their threshers are adapted to the thorough separation of all grains and of the smallest seeds; and they play a conspicuous part in agricultural industry in the wheat prairies of the West, the rice plantations of Louisiana, and the steppes of Eastern Europe.

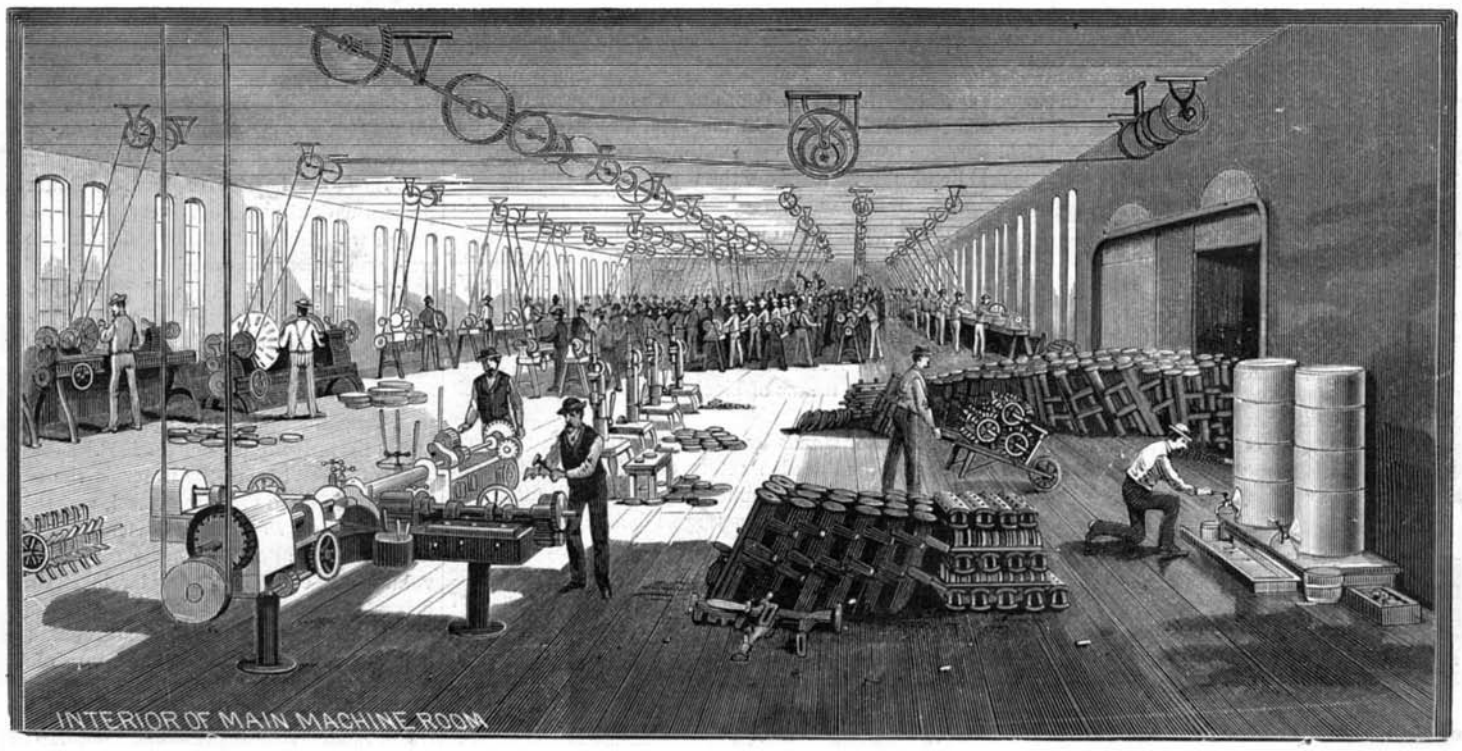
"The Canton Monitor" farm engine is the latest addition to the products of this great establishment. This is a safe, simple, and powerful motor, which is within the reach of every thrifty farmer, and perfectly easy to operate.

That steam is destined to play a conspicuous and most labor saving part in the conduct of all farm operations requiring power is a fact that has never been so conclusively demonstrated as by the history of the "Canton Monitor." Its sizes have been multiplied and its annual product has been doubled, trebled, and quadrupled, and yet there is no abatement in the increase of orders from year to year.

Although C. Aultman & Co. already construct more than double the number of agricultural engines made by any other house, it would seem that this department of their business was only in its infancy.

The New Model threshers are made in four sizes, and the Monitor engines in six sizes, ranging from six to twenty horse power. Both of these machines differ radically from any of the antiquated patterns. Although made by one of the oldest houses in the business, no merit is or can be claimed by reason of the antiquity of their products. On the contrary, they seek to embody all that is newest, safest, and best within the reach of human skill, invention, and abundant resources. In this field the "Monitor" road engine, which is shown in our illustrations, is an extraordinary exemplification of advanced attainment in this department. This engine is not only adapted to all agricultural operations requiring power, furnishing that power with the smallest possible expense, but is self-propelling, and very simple in construction and manipulation. And in these days when fatal boiler explosions are so apt to find a place in nearly every day's telegraphic summary of current events, this company may justly felicitate itself that not one such tragedy, or even a personal injury, has been caused by its machines.

In the competitive field the machines made by C. Aultman & Co. have been very successful. The highest honors have been awarded to them at all the great world's fairs. Twenty-one gold medals during the past three years signalize as many victories in the fields contested by the leading machines in the world. This great business has taken root in nearly every grain-growing region, including North and South Africa, New Zealand, Roumania, and all European nations. We understand that the company does not consign machines to foreign countries, but delivers to actual purchasers on shipboard at New York. Shipments of machines were lately made to St. Petersburg, Russia, and Leghorn, Italy. It is curious to note that in three or four European countries leading manufacturers have engaged in producing exact copies of both the grass and grain cutting and the threshing machines made by C. Aultman & Co. While this fact is highly creditable to American skill, it has its vexations to the American manufacturer who has to enter the competitive field against copies of his own products; and who, besides, in all countries beyond the English Channel does so under not a little dead weight in the shape of government duty.



WORKS OF C. AULTMAN & CO.

Reduction and Separation of Gold, Silver, Lead, and Copper.

BY DR. ROESSLER.

We are accustomed to laugh at the ancients for trying to separate gold and silver by fusing the alloy with sulphur and strewing litharge on the fused mass, or, as told of the Persians, the argentiferous silver was fused three times with copper and three times with sulphur. Yet on closer consideration we are astonished at how clever they were in these methods, and how thoroughly they made use of the few aids which they had then. In fact these processes furnish the key to a whole series of metallurgical operations, and timely changes in those principles may perhaps cause many more revolutions in metallurgical processes.

The first inducement to return to the old methods was the difficulties presented by the present methods in treating copper alloys which may contain considerable gold, without too much expense. Upon the ground of observations made in the Frankfort assay office, with the aid of L. Opificius, a new and improved process is likely to be perfected which promises to be of importance not in assay works merely, but also in lead and copper works.

It has been found that a mixed alloy containing gold, silver, and copper can be divided into two portions, one containing all the gold and most of the silver, and another of copper with a greater or smaller residue of silver but no gold in it. The manner of doing this is by the use of sulphur, which is melted with the alloy in such excess that it

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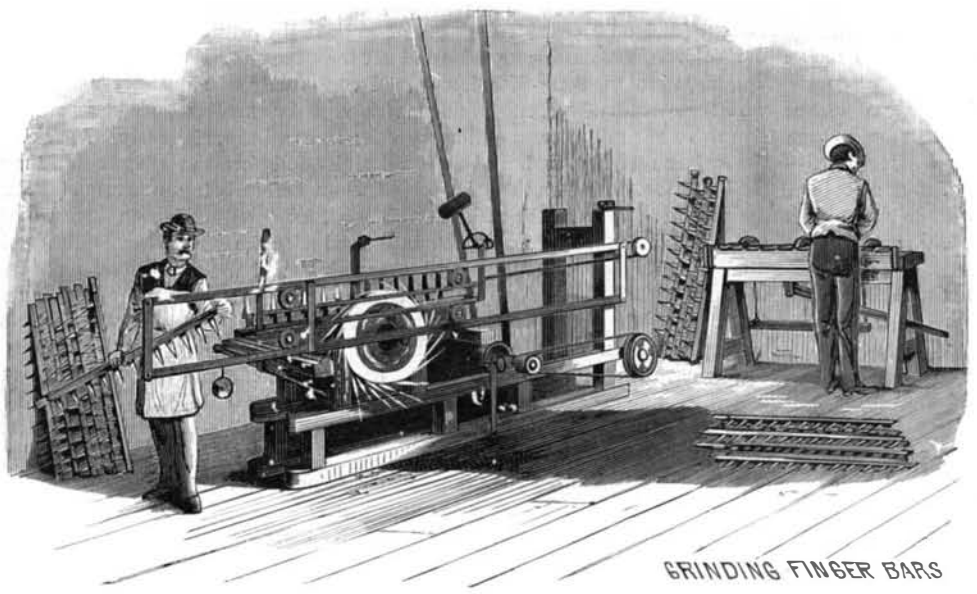
combines with all the copper and silver. Then by blowing air through the melted sulphurets a portion of the sulphur burns. This precipitates all the gold, which, in the presence of so much sulphur, was taken up by the sulphurets in large quantities; then most of the silver is thrown down, and a rich alloy is obtained which can be separated from the sulphuret of copper above it which is free from gold. The blowing of air through it here acts like the litharge did with the ancients, but more energetically and more rationally. With them, too, the sulphur was burned by the oxygen in the litharge and the metal separated as regulus. If the blast is turned off just at the right moment, the regulus will consist almost entirely of gold. First of all this process was only used as a preparation for the separation with sulphuric acid, so that all the gold and the greater part of the silver were thrown down, while the rest of the silver is found along with the copper, and free from gold, in the sulphurets above, which are afterwards reduced in another crucible to metal by blowing air through it.

In the Frankfort assay office 660 pounds of sulphide is melted at once in graphite crucibles. The air can be introduced into the fused mass by pumps or a cylinder blast, or, if the fusion takes place in a closed space, Koertling's steam injector can be used with an absorption vessel, in which the sulphurous acid is converted into sulphuric acid, and the particles of metal that are carried along settle there.

The principles mentioned above seem to be of great importance to lead and copper smelters, to whom the following points present themselves. The removal of gold from the copper matte and silver matte, as well as the removal of gold and silver from mattes containing both lead and copper, and the production of lead suitable for assay on the one hand, and of a copper matt free from gold and silver on the other. Well constructed closed crucible furnaces would offer special advantages, particularly in removing or utilizing the sulphurous acid for sulphuric acid, which certainly should not be under-estimated. P. N.



WORKS OF C. AULTMAN & CO.

Coating Dry Plates.

One of the minor difficulties in connection with the gelatine emulsion process is that of coating the plates. I have tried numerous ways of doing this, one of the best of which is no doubt the glass rod as used by Mr. W. K. Burton and others; but even with that the emulsion sometimes runs over the edge of the plate on to the glass beneath, and then comes the difficulty of getting the plate from the leveling glass. In doing this more of the emulsion runs off the plate, which renders it useless. Then there is the leveling glass to be wiped dry before one can go on, which means loss of time and temper. After several experiments I have hit upon a plan which, in my hands, is by far the best I have tried.

I use a strip of glass about five inches long and one inch wide for quarter-plates; for large plates it can be much wider. On one end I bind a double thickness of wash leather. I have my emulsion in an "invalid's cup," or deep saucer, in which stands my wash leather brush, and a silver spoon (a teaspoon for 5 by 4 plates and under). I now place the plate on a leveling stand (or it can be held at the corner the same as when coating with collodion), and with the wash leather brush I rapidly rub over the plate. The quantity of emulsion in the wash leather is sufficient to coat the plate with a thin film. I then quickly pour on the center of the plate from the spoon sufficient emulsion to properly cover the plate. If too much be poured on the excess can easily be drained back into the spoon, which prevents air-bubbles in the emulsion, as the plate can rest on the edge of the spoon. The emulsion will flow over the plate in a perfectly even wave, and it may then be put on the leveling glass to set.

I can coat between five and six dozen plates in an hour without losing a drop of emulsion over the edges; and an old photographer told me that it was impossible for them to be coated more evenly.

I think there are two important points gained by this way of coating plates: 1st. The spoon is a simple means of measuring the amount of emulsion required to cover the plate. 2d. It prevents frilling. I think one great cause of frilling lies in having the plates warm when coating, because the film then commences to set and dry on the top, causing the gelatine, as it gradually sets, to contract upward from the glass, leaving a number of minute, sponge-like spaces between the bulk of the film and the glass, and in developing the water gets into these spaces, causing the film to partially leave the glass. But by rapidly brushing a substratum of emulsion over the cold glass the latter chills it, causing the gelatine to contract on the glass, and, I believe, thoroughly prevents the film frilling. Further: by having this moist substratum of emulsion on the glass the spoonful of emulsion flows over the plate like oil, and renders the operation of coating plates one of the easiest possible.

To test the question as to whether the adhesion of the film was greater on a cold than a warm glass, I put two plates (coated and dried) in hot water. One of these, coated by a glass rod on a warm plate, dissolved away, leaving the glass clear and bright; the other, coated by the way I propose on cold glass, had a film on it which required much hotter water and more friction before I could remove it.—*Herbert S. Starnes, in Brit. Jour. of Phot.*

American Association Meeting.

The thirty-first meeting of the American Association for the Advancement of Science will be held in Montreal, beginning August 27, 1882, under the presidency of Principal J. W. Dawson, of McGill University. The chairman of the local committee is Dr. T. Sterry Hunt. This committee is very strong in its membership, and its several subcommittees are making strenuous efforts to secure a pleasant week for the visiting members. The headquarters of the Association will be at McGill University, where the general sessions and the meetings of the sections and committees will be held. Here also will be the offices of the local committee and the permanent secretary, Mr. F. W. Putnam, whose address until August 17, will be Salem, Mass.

Each of the nine sections will be presided over by a vice-president as follows:

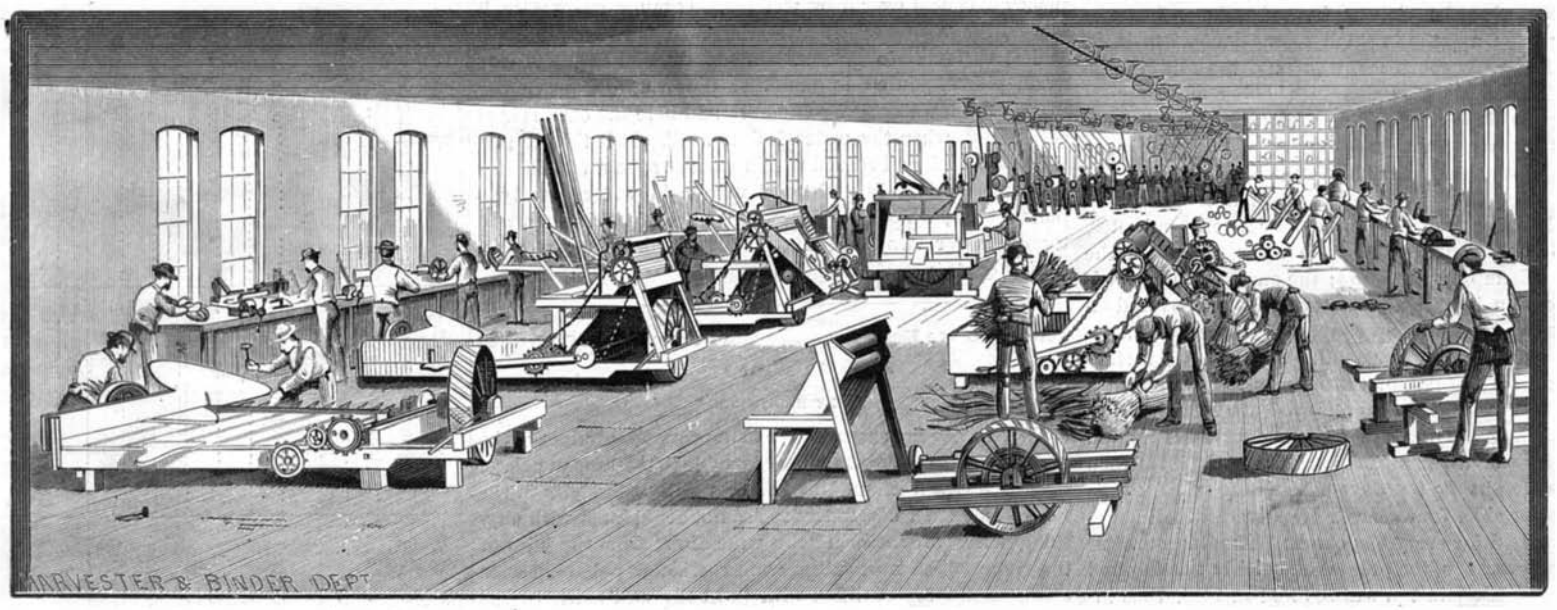
A. Mathematics and Astronomy, Wm. Harkness, of Washington; B. Physics, T. C. Mendenhall, of Columbus; C. Chemistry, H. C. Bolton, of Hartford; D. Mechanical Science, W. P. Trowbridge, of New Haven; E. Geology and Geography, E. T. Cox, of San Francisco; F. Biology, W. H. Dall, of Washington; G. Histology and Microscopy, A. H. Tuttle, of Columbus; H. Anthropology, Daniel Wilson, of Toronto; I. Economic Science and Statistics, E. B. Elliott, of Washington.

The Alps.

A remarkable work, on which a commission of the French Academy has just reported in terms of high appreciation, has been lately concluded by M. Civiale. He aimed at a complete description of the Alps, on a new plan, involving large use of photography. A preliminary study satisfied him that the central mass of the Alps, and the chains diverging into Germany, Austria, and France, might be divided into forty-one districts, such that, taking a central station in each, at sufficient height, one might obtain photographic panoramas of the whole. The plane of comparison (or ideal surface on which the author distributed his stations) is over 8,000 feet in altitude; and in some cases he had to climb more than 10,000 feet, taking, of course, apparatus with him—a sufficient indication of the difficulty of the enterprise which, in ten years, M. Civiale has successfully carried out. It was often difficult to fix the instruments on account of the wind. The line of sight once rendered horizontal in all directions, M. Civiale proceeded in each case to take photographs in fourteen different directions. These were afterward carefully joined. Such panoramas furnish at once the plane-mensuration, the relief, and the picturesque aspect of the country. In another section of his work M. Civiale deals with details. He traversed the valleys and photographed natural geological sections, snow limits, landslips, *roches moutonnées*, glaciers with their crevasses and moraines, *cols*, and so on—all that is interesting to the geologist, the engineer, and the tourist. Six hundred plates are devoted to these details, and the views given are pronounced remarkably good. In addition, M. Civiale gives much interesting information in his journal; he even rectifies the orthography of place names, and furnishes some historical details; also a catalogue of altitudes, mostly determined by himself. It is suggested by the commission that, in future time, it may be possible, by superposing panoramic views taken from the same stations on those of M. Civiale, the amount and character of secular demolition may be estimated.

Driven Wells for Fire Departments.

The fire department of Marshall, Michigan, has twenty-three driven wells ranging from 65 feet to 110 feet in depth. The piping is of wrought iron, one quarter inch thick and 6 inch bore. Their average cost was $325, and they have been in use twelve years without any expense. At the recent Convention of the Michigan State Firemen's Association, Chief Burpee said the driven wells were an entire success, and that they had never been able to pump one of them dry. The *Fireman's Journal* says that numerous other instances might be cited to show that driven wells are serviceable and trustworthy. Of course, they are not available in all places, but where they can be used they are economical and of great value. By attaching pumps to them, and pumping directly into the mains, driven wells have been found to give an abundant supply of water to good-sized cities for both domestic and fire purposes, furnishing streams directly from the hydrants under sufficient pressure to render splendid service in putting out fires.



WORKS OF C. AULTMAN & CO.

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Correspondence.

The Patent Bill now before the Senate.

To the Editor of the Scientific American:

May it not be hoped that before the crude and ill-advised bill (H. R. 6,018)—noticed in your journal—for "amendment of Section 4,919, Revised Statutes," is made a law the President will at least refer the matter to his legal advisers? Are there not deeper, wider, and graver interests at stake than those whose clamor has brought the Forty-seventh Congress to the verge of dishonor in the passage of this unjust, inexpedient, and mischievous measure? A sample of its crudity appears in that, while professedly modifying Sections 4,919 and 4,921 as to rights of recovery, it is silent as to Section 4,884, which (almost in the words of the constitutional clause) on the inventor's disclosure of the invention, etc., guarantees to him for a limited period the exclusive right to make, vend, and *use* the invention.

Of course the right of recovery for this species of tort or trespass has been abused occasionally, but not more so than any other vested right or franchise that can be mentioned—not one thousandth part as much as some of them; notably, those of land tenure, control of the world's necessaries (wheat, for example), highway privileges, and (may one not add?) legislation.

Besides, in the present temper of tribunals, the wrong is all the other way—"the boot is on the other leg," to wit, that of the trespasser, and a patentee's opportunities of acting arbitrarily are slim indeed.

The time is come for inventors to organize in self-vindication, and the writer suggests Cincinnati as the place of rendezvous, and first Monday in September as the time.

GEORGE H. KNIGHT.

Cincinnati, May 29, 1882.

Italian Cheese.

For many years the Italians have been celebrated for the excellence of their butter and cheese. Of the latter very many descriptions are made. In Piedmont, large quantities of "gruyera," "fontina," "rubiole," "grana," and "stracchino" are made, and these, according to Consul Crain, of Milan, are considered the best of the Piedmontese manufacture. "Gruyera" and "fontina" are made from the Estival pasturage of the Valley d'Aosta. "Rubiole" are small sheep's milk cheeses of Alba, Mondovi, and Acqui, whence they are exported in considerable quantities. "Grana" and "stracchino" are Hovarese products. The former is made during ten months of the year, the latter in October and November. A large quantity of excellent butter, "grana," and "stracchino," is made in Southern Lombardy and Mortara. Lecco, Varese, Bergamo, and Breschia produce good "stracchino" and butter, and delicious cheeses, called "formaggini," are made on the rich pasture of the Valtellina hills. The following is a description of the process employed in the manufacture of the various Italian cheeses. "Stracchino" of Gorgonzola is made of milk containing the buttery parts. When the mountain pasturage is exhausted, the Bergamese herdsmen drive, for winterings, their herds to the plains. Gorgonzola is their favorite halting place, as it is there they first find the luxurious vegetation of the Lombardian plateau. The herds, feeding on the rich grasses of Gorgonzola from the middle of September to the end of October, give plentiful supplies of milk. Cheese is made during these months in small rooms devoted to it, in the homes of the Gorgonzolese, who buy the milk of the herdsmen. The autumn temperature, being moderate, is best for cheese making, as too much heat, by hastening the separation of the whey, makes it too dry and friable, while excessive cold produces an acid taste. The milk while warm from the cow is curdled with well preserved and prepared calf rennet. In fifteen or twenty minutes, when the milk is coagulated and the whey separated, the curd is hung in hemp bags to drain; the curd, when drained, is then inclosed in light flexible wooden bands, covered on their inside surface with hemp cloth, and placed on an inclined plane strewn with rye chaff. The curd is further drained during the first day of the process by two or three turnings, and on the cloth being removed, its value is determined by weighing. After three or four days fermentation commences, and the wooden bands are removed. It is then once daily, for eight or ten days, alternately salted on its upper and lower side, four ounces of pulverized salt being on an average used for every 33 pounds. The Gorgonzolese adopted, some years ago, the process of quickly turning and pressing the cheese against a salt-covered surface, thus insuring more uniformity and a better crust. The color changes in a month: to pinkish white if good, to black if bad, as in this case the crust is soft and the cheese is apt to deteriorate in summer. It is calculated that about one hundred quarts of milk make about twenty-five pounds of cheese. "Bellunese" cheese is made by heating the milk, pouring in the rennet, letting it coagulate, breaking it into medium sized pieces, reheating, putting in wooden tubs, salting and placing on stands for daily turning, and resalting until consumed. The following process is employed in making a kind of Frinlani cheese, known as "fieno." Milk is heated until tepid in caldrons, then mixed with rennet and left to curdle. The curd is broken in vessels into small pieces, and violently shaken over the fire. When thus crumbled, the caldron being set on a stand, it is gathered, thrown into the "talcio" or forming tub, placed on tables for drainage, dried, and finally steeped in brine. In making "formaggio di grana," milk is poured into caldrons and placed on the fire; if mature, that is, of a bluish tint, it is warmed to the twenty-fifth degree; if sound, or retaining its whiteness and the sweet taste of freshly milked, it is heated to the thirtieth degree, then mixed with rennet. One-sixth of an ounce of rennet is used for 720 quarts of milk. The rennet is dissolved with a pestle in wooden cups, filtered through horse-hair sieves, the oozing going into the caldron of milk. To prevent hardness the curd formed is broken and turned with the cream turner, "rotilla" (a stick with a wooden disk at the end), and the "spino," or cane with twisted twigs or iron pins at one extremity, and this is continued for the space of three quarters of an hour. Turning is occasionally stopped to consolidate the now softened or dissolved curd. The whey is removed, and one-sixth of an ounce of saffron to every 110 quarts of milk is thrown into the caldron, the curd is replaced and left for an hour on the fire, heated to the forty-fifth degree, and continually stirred with the "rotilla." A cup is filled with curd for examination as to the minuteness of its particles; if small enough, the caldron is removed, and the curd sinks and forms at the bottom. To hasten this, the cooled whey, before being drained off to allow of the addition of saffron, is poured into the caldron, the bottom of which is pressed with the "rotilla" to unite the curd. The curd is then loosened with a stick from the sides, drawn on the surface, collected in a cloth, placed in a vat, and left there for an hour, and then moistened with whey. It is then marked with the name of the owner, pressed by hand in a box of narrow beech boards, bound with hoops and pack thread, and covered with linen, a wooden disk and a heavy stone. When dried, these coverings are removed, and it is moistened again with whey, and then covered with buckram. After some hours this buckram is cut, and the whey permitted to soak in. It is covered, and rubbed on an oak bench with salt, dipped in salt water, and again pressed between the beech boards; it is resalted every day for a fortnight and placed in the cheese house, where superfluous salt is removed by scraping. In September it is rubbed with cheap oil.

The cows of the numerous dairies of Puglia and Basilicata are milked once daily. The milk, when poured into large vats, and half heated to a point which will make it and the unheated, mixed—when tested by the hand—30° Réaumur. Whey of goats' milk is mixed and shaken in it, and when curdling it is covered with a cloth to keep up the temperature. When curdled, it is broken, stirred with the "rotolo" till it is in filbert-shaped pieces, placed with whey in a vat, beaten again, wetted, and covered with warm whey. When ductility is obtained by heating on hot coals or boiling in water, the curd is called "crescinta" or grown. It is then cut, the pieces thrown into the pail, where they are soaked in hot water, reunited, manipulated, pulled into thread, and made into as many balls as there are cheeses to be made. These thread balls are immersed in water, manipulated till perfectly compact, formed into proper shapes, and daily salted for two or three days. Cheese thus made is called "Caciocavallo de Puglia." "Proratura" cheese is made of cows' milk, which is poured into large pine tubs, dissolved kid rennet is added, and the mixture turned with the "rotolo." Upon coagulation the curd is not allowed to get lumpy, but is pressed and softened with the "rotolo." When the curd sinks in the vat, a sieve of pierced tin is placed and held over it by weights. If much whey rises, it is used for "ricotta;" if little, the sieve is removed, and it is left to facilitate growth. When ductile, it is cut into small pieces, poured into another pine vat, and previously prepared hot water poured upon it, and here the curd is kept till cooked, when the water is drawn off. It is then in portions gathered and stirred with a wooden spoon, and formed by hand, previously moistened with cold water, into two-pound balls, which are placed in tubs of cold water, and there left for two hours, and finally salted.—*Journal of the Society of Arts.*

How can we Best Increase the Percentage of Alcohol in Wine?

BY E. STRACHE.

There is a very general desire to improve the product of the grape, *i. e.*, to make it more acceptable to the human palate. From the Green Mountains in the north to Madeira in the south, only such consumers as are not acquainted with anything better are satisfied with wine direct from the juice of the grape. The more skilled and experienced palates of wine connoisseurs are satisfied with the body and spirit of the natural product only in exceptionally good wine years.

Besides removing or concealing the excess of acid in the wine, it is mostly the low percentage of alcohol that they try to improve. Wine chemists work in two different directions to accomplish this. In southern countries, from time immemorial it has been customary to increase the strength by adding spirits made from the wine itself. This addition of brandy also made it keep better. In northern regions, and especially in France, the aim was reached in a different manner, by adding sugar either to the must or to the young wine, and this was converted by distillation into alcohol.

As yet the question has not been thoroughly investigated which means is the more rational and corresponds best to the nature of wine and its destination, which is to be a means of enjoyment to mankind. It has simply been assumed that both methods yielded the same results: adding alcohol and making alcohol amounts to the same thing. But whoever has thoroughly studied human dietetics must acknowledge that merely fermented liquors, like beer and wine, exert a different action upon the system from distilled liquors or alcohol, and that this action is too often sadly noticeable, and he seeks to find the cause of this difference. Without mentioning more fully the totally different dietetic effects that are frequently observed from fermented and distilled liquors, we will only refer to them. But then this question naturally arises, whence comes the difference in their effects?

Hitherto it has been assumed that the alcohol in wine, in beer, and in other alcoholic drinks, is analogous, and has the same dietetic effect, and it is only the different percentage of alcohol and other different qualities of the liquor which produce different effects on the organism. A very essential difference in the chemical nature of the alcohol in wine and beer from that in distilled liquors has been previously observed. It is also a fact known to chemists, that alcohol can be separated from its solution in water in a concentrated state (97 per cent.) by means of carbonate of potash, which dissolves in the water, and as the alcohol is not soluble in a mixture of potash and water, it swims on top. It has also been found that fermented liquors must first be heated to their boiling points before the alcohol distills off, while the alcohol separates from mixtures of alcohol and water at a lower temperature.

It was also known that the alcohol cannot be separated from beer or wine by adding carbonate of potash, but they were satisfied to assume that in beer and wine the alcohol is combined with the coloring matter of the beverage, and therefore cannot be separated by the simple addition of potash.

Numerous experiments have convinced me that the alcohol in beer and wine and other fermented liquids exists in a different condition from what it does in distilled liquors, and that the substance formed by fermentation is not alcohol, *i. e.*, oxhydrate of ethyl, but a bihydrate of the oxide of ethyl, which loses half its water when it is heated to 212° Fahr. Unfortunately I did not succeed in establishing this hypothesis by experiment. But the necessity of explaining the different dietetic action of liquors that have been distilled from those that have not been, and especially the experiment with potash, both suffice to permit of the assumption of this or a similar compound of alcohol with water in fermented liquors.

If this hypothesis be admitted, the addition of alcohol to wine is no improvement, but an adulteration or falsification of the wine, and the question whether the percentage of alcohol can be increased just as well by adding alcohol as by the fermentation of sugar, must be answered in the negative. I am engaged in pursuing this question still further by trying whether it may not perhaps answer to add alcohol before fermentation just as well as to add sugar. It is possible that in the process of fermentation the alcohol may enter into combination with the water. Small experiments have almost led me to this conclusion.—*Vienna Agricultural Zeitung.*

Large Locomotives.

The *Railroad Gazette* tabulates as follows the weights and dimensions of the heaviest freight and passenger engines in use in this country:

Name of Railroad or Builder.	Kind of Locomotive.	Total Weight.	Weight on Driving Wheels.	Diameter of Driving Wheels.	Size of Cylinders.
Passenger Locomotives.					
Reading Railroad	Fast Express	96,300 lb.	*64,250 lb.	68 in.	21 × 22 in.
Pennsylvania Railroad	" " Class K	92,700 "	*65,300 "	78 "	18 × 24 "
Baldwin Locomotive Works	Fontaine Locomotive	98,000 "	†44,000 "	.....	16 × 24 "
Boston and Albany	Fast express	85,000 "	†35 to 45,000 lb.	78 "	18 × 24 "
Pennsylvania	" "	80,000 "	†56,000 lb.	66 "	18 × 22 "
	Freight Locomotives.				
	Tank locomotive	‡120,400 "	.....	60 "	17 × 24 "
Reading Railroad	Consolidation	102,000 "	88,500 lb.	50 "	20 × 24 "
" "	Twelve wheels coupled	101,000 "	101,000 "	46 "	20 × 26 "
Atchison, Topeka, and Santa Fe	Consolidation, tank	§115,000 "	§100,000 "	48 "	17 × 24 "
Central Pacific	Mogul, tank	.....	88,000 "	48 "	16 × 24 "

* On four wheels. † On two wheels. ‡ Reported weight. §Estimated

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Australian Trees and Mines.

One of the most curious sights in the bush was that of the ancient tracks of the aborigines up the trees, which had been climbed by them to obtain opossums or wild honey. These tracks are the series of small notches, made each by three blows of the tomahawk, to admit the great toes, and thus act as a ladder to the black man. The tracks, which are to be seen everywhere in Australia, lead to the most astonishing heights, up bare, perpendicular, smooth-barked gum trees. Knowing bushmen can distinguish the ancient ones, made by the stone tomahawk, before the blacks obtained iron from the English.

Many are to be seen on old, dead, barkless tree trunks. Now that the blacks are gone, they remind one of fossil footprints of extinct animals. Marvelous as this power of climbing with so little support is, it can be done by whites, and I was assured in New South Wales, when on the Hawkesbury River, that there was a white man in the neighborhood who could beat any black at this sort of climbing, doing it in exactly the same way, and being often employed by my informant in collecting wild honey for him at so much a nest.

In the same way there are said to be whites who can throw the boomerang better than any blacks. In fact, a white man, when he brings his superior faculties to bear on the matter, can always beat a savage in his own field, except perhaps at tracking.

We looked up into all the trees for a native bear (*Phascolaretus cinereus*), and saw tracks of kangaroos, but not the animals themselves.

We stayed out only one night, and got back as we arrived, only at nightfall, after a protracted struggle with the mud.

The roads were mostly short cuts, and were what are called "made," but not "metaled."

Making a road is simply clearing of trees a line of ground of a certain breadth, and marking the bounds with a plow. In using such a road constant divergencies have to be successively made in order to avoid deep mud and swampy bits, or occasionally fallen trees, and the track gradually widens and straggles in the adjoining bush.

My next excursion was to Sandhurst, a rapidly grown mining town, which has arisen since 1851, at the site of the most paying Victorian diggings.

The railway for a long distance, as it nears Sandhurst, passes through the midst of various sites of old diggings.

The surface of the ground on each side of the line for miles at a stretch has been turned over, scooped out, and heaped up, and presents the appearance of an endless succession of deserted gravel pits.

Here and there a few solitary diggers, mostly Chinamen, were rewashing the dirt, but nearly all was waste and bare. The vast extent of the fields and amount of work done astonished me.

Sandhurst, or Bendigo, is a large town with a newly run-up appearance, built among the openings of the shafts of the numerous mines.

The surface gold was long ago worked out, and the rich quartz reefs below are now being mined by means of shafts and drives. A new shaft was being sunk in the very center of the town, in front of the principal banks and the veranda covered pavements, which were crowded with share brokers doing business in the open streets.

The great winding wheel and its supports looked out of place in the middle of the principal square and public garden of the city.

I went down two of the mines, and saw specks of gold in the richest quartz reef. Some of the very richest quartz, however, hardly shows the gold to the eye, for the metal lies hid in black, dirty looking streaks in the white rock, and is only brought to light after the process of crushing and amalgamation.

I saw also the crushing establishments, where the din of the heavy iron stampers, falling with a crash upon the quartz, was absolutely deafening.

Although the men employed in feeding the stampers are from habit able to converse, notwithstanding the noise, I could not hear in the least when my companion shouted into my very ear.

I saw the pasty amalgam and the gold fish from the retort, known as "cake," and finally I handled heavy masses of melted cake forged into solid ingots, worth many thousand pounds. The mining people were most hospitable.

My last excursion was up the valley of the Yarra, to the beginning of the "ranges," the Australian word for mountains, at a place called Healesville. I went with one of the assistants of Baron von Müller, the celebrated botanist, who kindly offered me his assistant as a guide.

My object was to see some of the enormous eucalyptus trees which grow in the "ranges," and which as discovered by Baron von Müller are the highest trees in the world, exceeding in height the sequoia gigantea of California. One of these trees, measured when fallen, was found by Baron Müller to be 478 feet in length.—*H. N. Moseley—Challenger Notes.*

Heavy Work on the Canadian Pacific.

Mr. Edward G. Tilton, Chief Engineer and General Superintendent of the Canadian Pacific Railway, when in Portland, Oregon, in the forepart of May, gave to the *Oregonian* some interesting facts relative to the progress and prospects of that road. On the Fraser River the completed section of twenty-three miles northeast from Emory, B. C., has given employment to 1,500 men for eighteen months.

The work from Emory to Thompson's River, a distance of sixty miles, is probably the most difficult and expensive on the North American Continent. Fraser River is bordered with steep and rugged mountains of solid granite, from 6,000 to 8,000 feet high. In the first seventeen miles there are thirteen tunnels, four in one mile and six in another. Two miles on the division about Emory there are no less than 600 trestles and bridges, and in the last eighty-five miles more than 100 embankments. At the formation the levels are seventeen feet wide and the cuts twenty-two feet. The tunnels are twenty-two feet wide and twenty-one feet high. None other than fifty-eight pound steel rails are used in the upper sections of the work. There are 10,000,000 cubic yards of earth excavation, 3,000,000 cubic yards of rock, exclusive of tunnel, and 2,000,000 cubic yards more of rock and cemented gravel in the excavations. Between 30,000,000 and 40,000,000 feet of timber, board measure, is required for structures over the entire contracts. The rock is of the hardest compact granite, in which often occur wide and extremely hard quartz veins. For miles the road is literally hewn out of the side of the cliffs. The approaches to many of the tunnels are by galleries. At the eastern approach to tunnel No. 7, for over 100 feet the bluff is galleried, and overhangs the roadway twenty-four feet in width, or two feet outside the roadbed, below which is an almost perpendicular precipice of 200 feet. The first tunnel is at the north end of Yale, and the first four happen to be within a mile and a half of the town. It required eighteen months to build the first two miles, working in the tunnels night and day. From one point six tunnels are visible at a glance. The grades and curves are moderate, the heaviest grade being fifty feet to the mile. The line follows the west bank of the Fraser River to a point eight miles below Lytton, where Thompson River enters into the Fraser. Here the latter river will be crossed by an iron and steel bridge, to cost $300,000. The line will then follow the south bank of the Thompson River to Kamloop's Lake. The contractors expect to have completed by the end of this year 120 miles of the grade, and have 50 miles of the track in operation. The first two miles north from Emory have cost a trifle over $200,000 per mile, and eleven miles—from the eighteenth to the twenty-ninth—cost $175,000 per mile. The average cost per mile of the upper division along the Fraser and the Thompson River will be over $75,000 per mile. This does not include the cost of rails and fastenings, which are furnished by the government. The 212 miles from Port Moody to Kamloop's Lake will cost, exclusive of rails, $12,000,000. The company have at Yale their own nitroglycerine and powder works, with a capacity of 4,000 barrels per day, car and machine shops, and all supply departments. A steamer is under construction, and will be launched in a few days, for navigation on the Upper Fraser, between Boston Bar and the mouth of Thompson River. The boat is intended for the transportation of supplies, and will be the first to ascend above Boston Bar.

Testing the Purity of Salicylic Acid.

Dr. F. Von Heyden gives the following method for testing salicylic acid: From 0·3 to 0·5 gramme of the acid to be tested is put in a test tube and dissolved in the least possible quantity of absolute alcohol. The clear solution is then poured on a watch glass, which is placed on a white surface. Mechanical impurities settle to the bottom and are seen in the middle of the glass. The nature of the impurity can be ascertained by means of the microscope. On allowing the alcohol to evaporate in an atmosphere as free as possible from dust and iron, the acid will crystallize in beautiful efflorescence, when the following points are to be observed:

1. If the points of the needles are brown and thick, the acid contains resinous matter or carbolic compounds, and the preparation is worthless.

2. If the points are very light yellow, but not globular and not thick and melted together like fungi, but fine like trees or moss, then it is free from resin and carbolic acid, but not entirely free from a trace of an organic coloring matter.

3. If the points are clear, colorless, mossy, and tender, without spherical points, the preparation will pass muster.

4. If the points are violet or pink, the preparation contains traces of iron.

5. When burned on a platinum foil it should not leave any incombustible residue behind.

In some cases salicylic acid, which passed all these tests before it left the factory, has, after shipment, acquired a faint pinkish shade, while some of the same product which stayed there or went elsewhere, and which was taken out of the same vessel at the same time, remained perfectly white yet the acid which had this color stood all the above tests for purity afterward as well as it did before it left the factory.—*D. I. Z.*

The St. Gothard Railway.

The St. Gothard Railway, the formal opening of which has just been celebrated with international banquets and other fêtes, begins at Roskreuz, eleven miles from Lucerne, runs along the western shore of Lake Zug, round the base of the Righi and by Lake Lowerz, striking the Lake of Lucerne at Brunnen. From Fluelen the line begins to ascend the valley of the Reuss, attaining an altitude of 1,558 feet about the level of the sea at the village of Erstfield, five miles from Fluelen. Up to this point the gradient of the line nowhere exceeds 10 in 1,000; but from Erstfield to the next station, Amsteg, it rises 26 feet in every 1,000. From Amsteg the line runs through a number of short tunnels and over a number of bridges to Gurtnellen, eight miles from Fluelen, where it attains an altitude of 2,427 feet. From Gurtnellen the line ascends the mountain side in a series of bold spirals, crossing the Reuss several times, and passing through the Pfaffensprung Tunnel, 1,487 meters in length; and then, running through the Wattingen Tunnel, reaches the station of Wasen, 3,008 feet above the sea level. Leaving Wasen, the line runs back again in the direction of Fluelen; then turning, passes through the Naxberg tunnel, 1,570 meters in length, and reaches the station of Göschenen. Here the St. Gothard Tunnel, nine and a half miles long, begins.

The Bacillus of Phthisis.

In the *Berliner klinische Wochenschrift*, of April 10, a full account is given of Dr. R. Koch's investigation of the bacillus said to cause phthisis. It was detected by treating tuberculous substance, obtained from the lung of man or the ape, with methylene blue, and subsequently with a concentrated watery solution of vesuvin, when the tubercle bacillus alone remains blue. The bacillus of leprosy is the only other one known at present which will resist the brown staining of vesuvin, and even it is distinguished by taking a certain coloring, devised by Weigert, which the bacillus of tubercle resists. When carefully cultivated on the coagulated blood plasma of the ox, so as to be obtained in the pure state, this bacillus was found to be capable of producing tuberculosis in all animals inoculated with it, without exception. One practical point arises from this investigation. Dr. Koch finds that even the dried sputum of phthisical patients will produce tubercle when inoculated. Hitherto no care has been taken to deprive the expectoration of phthisical patients of the power of doing harm. How far phthisical expectoration, scattered over the pavements of the great cities, may, on a dry and dusty day, have the power of spreading the disease, seems to be a point that may be worthy of inquiry. So important is this discovery, or rather absolute confirmation of previous discoveries, considered to be that a long letter from Professor Tyndall and a leader on the subject appeared in the London *Times*.

Coloring Cements.

The pigments employed to color hydraulic and other cements, and obtain the shades common in trade, are, according to the *Bauzeitung*, the following, the proportions used being those used by R. Dyckerhoff, of Amoeneburg:

For black, pyrolusite	12	per cent
" red, caput mortuum	6	"
" green, ultramarine green	6	"
" blue, ultramarine blue	5	"
" yellow / " brown } ocher	6	"

The strength of the cement is rather increased by the addition of ultramarine pigments, but somewhat diminished by the others. The ill effects of the latter may be somewhat removed by grinding the cement again after the pigment has been added, whereby it gains in fineness, and the strength is so much increased that no difference is observable between this and the ordinary cement. The black and red cements made in Dyckerhoff's works for making tiles and artificial stone show a strength by normal tests after twenty-four hours' drying of 20 kilos per square centimeter, or about 275 pounds per square inch—a very respectable strain for such work.

Weights of Timber, Lumber, and Cordwood.

The following tables are given in a recent publication of H. K. Porter & Co., of Pittsburg, Pa.:

WEIGHT OF GREEN LOGS TO SCALE 1,000 FEET, BOARD MEASURE.

Yellow pine (Southern)	8,000 to 10,000 lb.
Norway pine (Michigan)	7,000 " 8,000 "
White pine (Mich.) off of stump	6,000 " 7,000 "
White pine (Mich.) out of water	7,000 " 8,000 "
White pine (Pennsylvania), bark off	5,000 " 6,000 "
Hemlock (Pennsylvania), bark off	6,000 " 7,000 "

WEIGHT OF 1,000 FEET OF LUMBER, BOARD MEASURE.

Yellow or Norway pine	Dry, 3,000 lb.; Green, 5,000 lb.
White pine	Dry, 2,500 lb.; Green, 4,000 lb.

WEIGHT OF ONE CORD OF SEASONED WOOD, 128 CUBIC FEET PER CORD.

Hickory or sugar maple	4,500 lb.
White oak	3,850 "
Beech, red oak, or black oak	3,250 "
Poplar, chestnut, or elm	2,350 "
Pine (white or Norway)	2,000 "
Hemlock bark, dry	2,200 "

(1 cord bark got from 1,500 feet logs.)

A New Theory of the Formation of Coal.

After a protracted microscopic study of coal, Prof. Reinsch has come to the conclusion that coal was not derived from land plants, but chiefly from microscopic forms of "a lower order of protoplasm." He holds that plants of a higher order have contributed but a fraction of the mass of coal veins, however numerous they may have been in some instances. In a recent lecture, stating his conclusions, Prof. Reinsch referred to the fact that Dr. Muck, of Bochum, held that algæ have mainly contributed to the formation of coal, and that marine plants were rarely found in coal because of their tendency to decompose, and that calcareous remains of mollusks disappeared on account of the rapid formation of carbonic acid during the process of carbonization.

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An Electric Railway for St. Gothard Tunnel.

At present four daily trains are taken each way through the St. Gothard Tunnel, but even with this slight traffic ventilation is a serious problem. In some of the shorter tunnels leading up to the great one the inclines are so steep that a locomotive is required at each end of the train, and the men in charge of the one at the rear have to be supplied with reservoirs of pure air from which to breathe. It is manifest that a new system must be adopted as soon as the completion of connecting lines makes the tunnel traffic heavy. With this in view, the chief engineer, M. Bridel, has sought the services of the Messrs. Siemens, who prescribe an electric railway on a similar system to that adopted by them in Paris. There is an abundance of water power near the entrance to the tunnel, and that will be utilized to drive turbines working the dynamos. A one-inch copper rod will be carried through the tunnel, on which a little carriage will run in electrical connection with the electro-motor on the train. Current will thus be supplied throughout the journey, the rails serving the purpose of a return wire. The expense of this experiment will be about 180,000 francs, but if it should not succeed the value of the plant will reduce the loss to 80,000 francs.

A Man Who Has Walked 175,200 Miles.

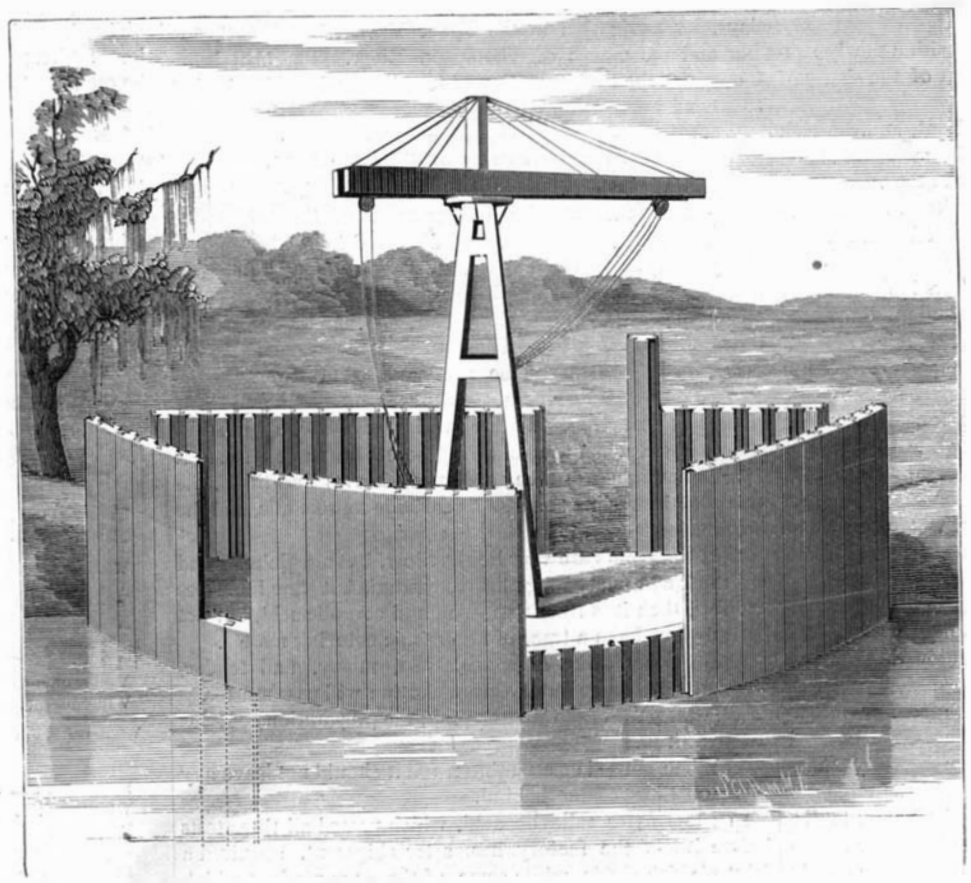
George Fawcett completed in April last his forty-seventh year of service in the English Post Office as a rural messenger. From 1835 to 1842 he rode between Sedbergh and adjacent stations, carrying mails in this way a total distance of 67,160 miles. From 1842 to 1882 he has walked daily between Sedbergh and Dent, thus traversing 175,200 miles. His entire travel as postman foots up 242,360 miles, nearly ten times the distance round the earth, and 2,360 miles further than from the earth to the moon.

METHOD OF STOPPING CREVASSES.

Owing to the want of sufficient elevation, both banks of the lower Mississippi river, except at a very few points, are subject to inundation whenever there is a freshet in the river, and earth embankments are thrown up, to protect the rich lands that border on the river. Sometimes a crevasse, as a break in the levee is termed, occurs from too great pressure of water, or imperfect construction of the levee, and no one who has read the daily papers for the past few weeks needs to be told of the great destruction of property, loss of life, and the want and misery that follows from a crevasse. No certain means of stopping them has been devised; the necessity for such a means was never greater than at present.

In the accompanying engraving is shown Gossin's floating dock for stopping crevasses, which is a flat-bottomed boat of any suitable length, from two to six hundred feet, having one of its sides straight, while the other is curved to better resist the pressure of the current. The boat is provided with water valves of sufficient capacity to secure a rapid sinking by the admission of water, and also with pumps to discharge the water after the break is closed. In the external surface of the hull of the boat are formed perpendicular dovetail grooves, which receive corresponding projections on one of the sides of heavy planks or piles. The location of the grooves is such as will secure close contact of the piles when they are in position on the boat. Cranes to which are connected pile drivers are placed in the boat. In stopping a crevasse, after ascertaining the precise depth of the water in the break over the natural surface of the bank, the dock, completely surrounded by the coating of piles, is taken by a tow boat just above the crevasse, the curved side being next the shore, and fastened at its lower end by strong ropes. The dock is then sunk by admitting water, until the bottom is lower than the natural bank, when by the influence of the current its upper end is swung around until it comes in contact with the levee below the crevasse, the straight side being next to the shore. The pile drivers are instantly put into operation, to drive the piles into the earth first upon the straight side, and if that does not stop the water, then upon the convex side, and if it is necessary, a tarpaulin may be lowered on the outside of the boat in such a manner as to cover the whole face of the piles and a few feet of the bottom beyond the piles, and this will be found absolutely effectual. As soon as the flow of water is stopped, the levee is thrown up anew and the piles are drawn, and the dock may at once be taken to another crevasse if needed.

Further information in regard to this ingenious device may be obtained from Mr. A. Gossin, Lafourche, Lafourche Parish, La.



GOSSIN'S FLOATING DOCK FOR STOPPING CREVASSES.

To compute the horse-power of a boiler, get the total number of square feet of heating surface, divide by 12=H.P.

A SIMPLE WAY TO CONVERT A PILLAR AND CLAW STAND TO AN EQUATORIAL.

BY F. G BLINN.

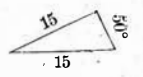
Almost every one who is the possessor of an astronomical telescope mounted on a pillar and claw stand has remarked the difficulty experienced of keeping in the field of view any of the heavenly bodies, and, if the observation be interrupted for a short time, of finding them again. This is especially noticeable if using a high power eye piece and not having a finder.

The contrivance here described answers the purpose of an equatorial mounting when used with the pillar and claw stand, *i. e.*, enabling one to follow the star by a single motion.

The parts should be made from 1½ or 2 inch boards, and

EQUATORIAL MOUNTING.

should consist of two pieces, say 15 inches square, and two wedge-shaped pieces subtending an angle equal to the co-latitude of the place (*i. e.*, 90° — lat.; thus, if the lat. be 40° 00′ the angle should be 50° 00′), and 15 inches on two edges. Now fasten these two triangular shaped pieces, as A, on opposite sides of the piece, B, taking care they should stand perpendicular to B, and their ends even with the side, D; on top of these two pieces fasten C; no adjustment for this piece is necessary; now you have finished. The pillar and claw are now to be taken from the tripod head and fastened at F. In case the glass is 4 inches or over it would be advisable to fill the inside of the stand with iron or rocks to insure steadiness.



If one has the space out-of doors it would be a good plan to erect a pillar having a level top, on which is fastened a strip of brass lying in the plane of the meridian; then it is only necessary to set the edge, B, parallel in this to insure the whole being in adjustment, as the stand might be occasionally disturbed.

THE deepest mine in the world, according to Prof. H. Hoefer of the Académie Impériale des Mines, is the Przibram silver mine in Bohemia. The lowest depth is nearly 3,300 feet below the surface. At this depth the temperature of the rocks is only 75·90° F.; and the temperature of the air 76·3° F.

Work of the U. S. Fish Commission.

Some extensive shipments of young shad and herring were recently made by the Fish Commission from Washington. One million shad and two million herring were sent to Austin, Texas, where they were placed in the Colorado River; three hundred thousand shad to Farmville, Va., to stock the waters of the Appomattox; three hundred thousand to South Carolina; three hundred thousand to the Rappahannock River; and three hundred thousand to the Upper Potomac, at Harper's Ferry. The young fish were transported in closed tin pails, each holding from twenty thousand to twenty-five thousand fish. The Quantico fishery, which has just been discontinued, the shad having moved further up the river, netted alone over three million shad and sixty million herring. The Fish Hawk, the government vessel stationed at Quantico, under the command of Captain Tanner, goes to the Susquehanna fishery, just below Havre de Grace. Up to the present time there have been shipped this year and deposited about six million shad. The work of the entire season will probably embrace the distribution of nearly eighty million shad and countless millions of herrings.

Prof. Stebbing's Photo Emulsion.

The bromide is dissolved in water with a very small quantity of gelatine, and the silver is then added in strong solution *without* any special care, except to secure that the precipitate of silver bromide shall separate readily and completely from the liquid. After washing the precipitate in two or three changes of distilled water, a small quantity of ammonia and a few grains of bromide of potassium, together with a few drops of alcoholic solution of thymol, are added to the granular bromide in a glass flask, and the whole thoroughly shaken, when in a minute or two the bromide becomes perfectly fine and forms a smooth emulsion. The bulk of gelatine, previously steeped in water, is then added and the flask plunged into a vessel of water at the temperature of 50° Centigrade (about 120° Fahr.), and allowed to emulsify. If a moderately rapid plate be required ten minutes' cooking will suffice; for the highest degree of rapidity, twenty-four hours. The solvent action of the potassium bromide produces the breaking up of the granular bromide, while the ammonia produces sensitiveness.

War Handkerchiefs.

The ancient custom of illustrating pocket handkerchiefs for the amusement and instruction of children has been seriously emulated by the French War Office for the benefit of the national army. The cotton handkerchiefs provided for the French soldiers are now decorated with special texts and cuts for the technical and sanitary instruction of the wearers. The center is occupied with the Cross of the Legion of Honor upon a red background, and the inscription underneath it, *Honneur et Patrie.* Around this central point are grouped a circle of medallions, containing representations of officers of all grades, from the modest sub-lieutenant to the proud commandant of a *corps d'armée.* The different uniforms are pictured so distinctly that the French private can tell at a glance to what grade any officer whom he sees may have attained. The special pocket handkerchief prepared for the infantry soldier has exact drawings of the arms used by him, with explanations of their mechanism. The borders of the handkerchiefs are hemmed in with a framework of the national colors, and within this framework are printed a number of sanitary precepts to be observed on march and during a campaign. Here are some of the marching advices: "Wear the cravat loose. A strip of flannel day and night around the body in order to keep off the diarrhea. Quench thirst with very small doses of wine, coffee, vinegar-and-water, or brandy-and-water. Take a piece of bread and a little coffee before the march. Spirituous drinks do more harm than good. Drink water neither hastily nor too cold. In quarters wash face and hands, and when possible the whole body. Wash the feet and rub in a little fat or brandy. Next cook the soup, and do it at once, even though feeling quite tired out."

Reclamation of the Zuyder Zee.

The preliminary surveys for the proposed reclamation of the Zuyder Zee have been finished, and the work of building the walls will soon begin. A dike about 24½ miles in length will be constructed of sand and faced with clay, reaching 16 feet above the level of the sea, which will make it about 6½ feet above the highest tide. The thickness of the dike will be such as will enable it to resist the heaviest seas. Operations will begin at four different points, and the calculation is to have it completed in from seven to ten years, at a cost of $46,000,000.

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KABATH'S CORRUGATED ACCUMULATORS.

There is now no doubt that the remarkable labors of Mr. Gaston Planté have been the starting point for all the researches that have been made for more than a year with a view to giving his invention all those qualities that are necessary for the industrial application of it.

To tell the truth, the scientific principles which are so clearly set forth in his *Recherches sur l'Electricité* have not for a moment been departed from; and, for more than twenty years, lead, oxidized and reduced, has formed the basis of all accumulators of whatever power and of whatever value.

It is through the promptings of such scientific principles that the accumulators that we are about to describe have been invented; but, in devising them, an effort has been made to give them the industrial qualities that were lacking in the Planté accumulators, and it is for no other reason than this that we make them known.

Formerly Mr. Planté's accumulators were constructed of small dimensions, their weight not exceeding 5 kilogrammes, which is absolutely insufficient for storing up immense quantities of electricity. It is for this reason that there have since been successively brought out types of 8, 10, 15, 20, and 60 kilogrammes. The limit has not yet been reached in this direction, and, in an important installation in which the electric reservoirs are to remain stationary, there is no obstacle in the way of constructing accumulators weighing several tons each. In applications where it is necessary to move the apparatus about, the increase of weight leads to a doing away with the too heavy and too fragile glass vessels. These latter at present serve only for laboratory apparatus of a weight less than 10 kilogrammes. Wooden boxes lined with lead are now almost exclusively employed. In certain applications where lightness is also necessary, recourse might be had to ebonite, although that is a relatively dear material.

strips of lead, one-tenth of a millimeter in thickness, and of a suitable length. These small plates of lead are alternately corrugated and flat, and are juxtaposed so as to finally form a sort of partitioned plate, from 8 to 9 centimeters wide, containing from 80 to 100 small plates thus arranged. They are kept firmly in position by means of a leaden plate pierced with quincuncially arranged holes, and which,

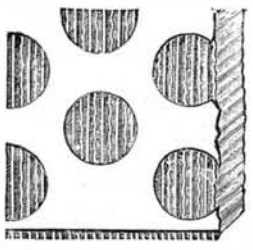


Fig. 1.—Portion of a plate of the corrugated accumulator.

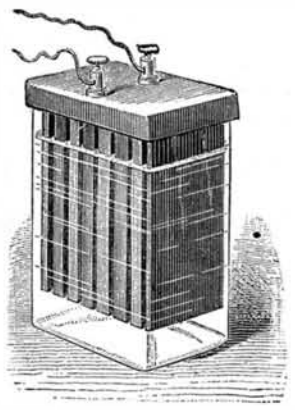


Fig. 2.—Corrugated accumulator. Laboratory style.

although it envelops them, allows of a free circulation of the liquid (Figs. 1 and 3). To each of the plates thus constructed there is fixed a conducting rod, which serves to connect it with the corresponding terminal. The vertical type (Fig. 3) consists of twelve plates like this connected alternately with one and the other terminal. The two end plates are simple sheets of lead, thus making the total number of plates fourteen. They are firmly set into the cover

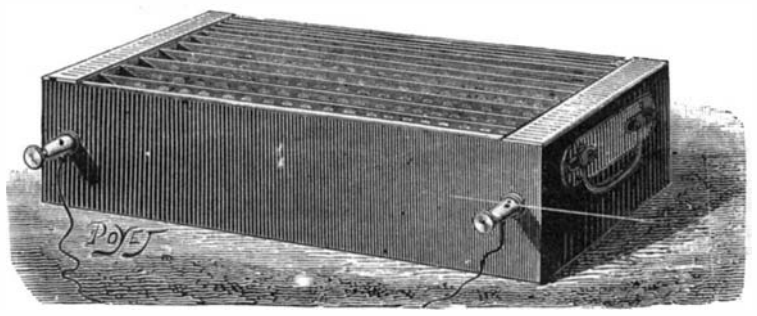


Fig. 4.—Corrugated Accumulator. Horizontal form for industrial purposes.

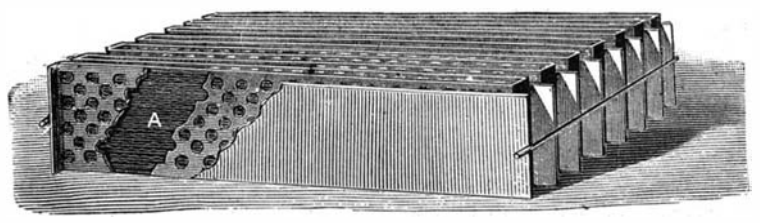


Fig. 5.—Arrangement of the plates during manufacture.

Latterly attention has been bestowed on the construction of as light accumulators as possible, considering their storage power. The means employed consists in much increasing the *active* surface of the plates without proportionally increasing the weight; for it is at the surface, and over a relatively slight thickness, that are produced those reactions which give rise to the secondary current.

Mr. Faure, with a view to diminishing the duration of formation, has sought for an increase in the storage power, not by increasing the *active surface*, but, on the contrary, the *thickness* of this active part, by fixing to each side of the leaden plates a layer of red lead, which the current oxidizes and reduces during the formation.

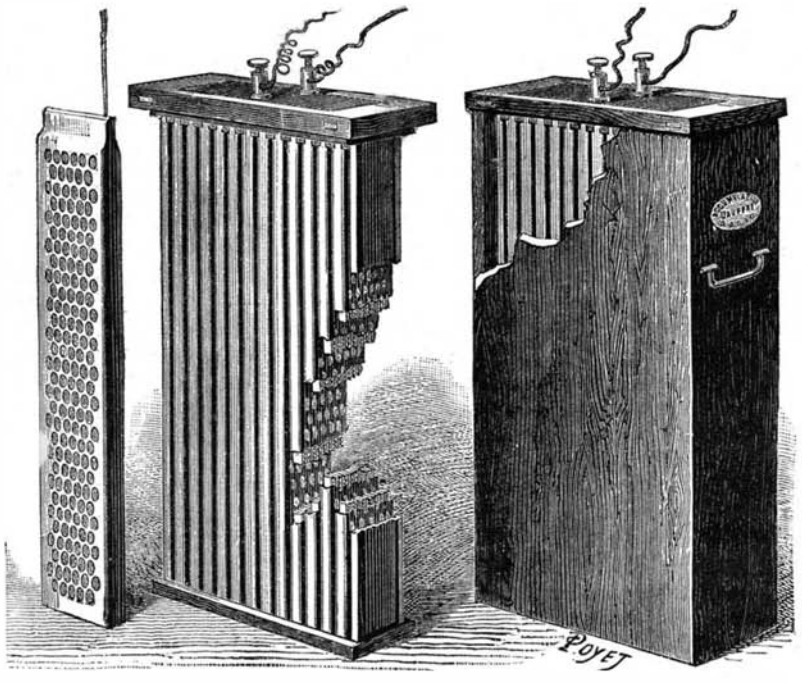
The advantage, which is a genuine one as regards the duration of formation, does not appear to be so well established as to the absolute power of storage. This opinion is that of Mr. Faure himself, and was given in a letter addressed to Mr. Hospitalier, April 10, 1882, from which we extract the following passage:

"I have bestowed much attention on the electro-chemical theory of my pile; and, through repeated analyses of the active layers of the electrodes at different periods of charge and discharge, and account being taken of the current that had passed, between two experiments, I think I am able to assert that the effect immediately observable was the conveyance of a certain quantity of oxygen from one electrode to another, and *vice versa*, according to the proportion established in electro chemistry; and that, during a discharge, for example, the reduced lead became Pb_2O, while the peroxidized lead, Pb_2O_4, became Pb_2O_3. But I have observed that this took place only in a *small proportion of the total mass of the layers*, about 10 per cent. I attribute that to the resistance that a *quasi*-solid material, like spongy lead and its oxides, offers to the transmission of the electrolytic wave. In fact, *a considerable portion of the mass escapes the action of the current.* Still, I have reason to believe that by the mixtures indicated in my patents, and by care in construction, I shall succeed in very considerably increasing the charge capacity of my piles."

Let us now take up the description of the accumulator to see how a considerable increase of surface has been attained, while at the same time the system has been kept at a relatively moderate weight. The pile consists of a series of vertical plates, the internal arrangement of which may be seen in Fig. 1. Each of these plates is composed of a series of at the upper part, and are held at the lower part by inserting them into an insulating cement formed of rosin and paraffine.

In the laboratory type (Fig. 2) the plates are smaller, and only six in number, and they are placed in a glass vessel, which allows of the phenomena of charge and discharge being studied.

In the vertical model for industrial purposes (Fig. 3) the receptacle is of wood lined with lead, and provided with handles, which permit of its being easily maneuvered. The plates are about 40 centimeters in height, 85 millimeters in width, and 1 centimeter in thickness. The accumulator, including its box, weighs 30 kilogrammes without liquid, and about 35 kilogrammes with water acidulated to one-tenth, all ready to work.



One of the plates. Mounting of the plates. Accumulator in its box.

Fig. 3.—Corrugated Accumulator. Vertical form for industrial purposes.

The horizontal type (Fig. 4) contains only ten plates, and weighs only 25 kilogrammes. It is less transportable, but has more stability, and is specially adapted for stationary installations. The plates are fixed by their extremities by inserting these in the insulating cement, their proper position being preserved by pieces of wood, which are removed as soon as the cement has set (Fig. 5). The terminals are on the side of the box, thus permitting of the accumulators being placed one on top of the other in the form of a pile. These corrugated accumulators are still of too recent date to allow us to pass a judgment on their practical value. At all events, being based on the same principles as the Planté accumulators, they possess qualities at least equal to those of the latter, while at the same time they possess industrial qualities that have hitherto been lacking in the laboratory apparatus constructed for a purely scientific purpose by the learned physicist just named.—*L'Electricien.*

"Water Hammer" Action in Earthquakes.

In a recent paper on the causes of volcanic action, Professor Prestwich assumes the existence of hot reservoirs or cavities filled with molten rock, and cold reservoirs or cavities, nearer the surface, filled with water; and he supposes the shrinkage of the earth to squeeze up the molten rock till it meets with the water, which then explodes, producing a volcano.

Mr. Thomas Mudd suggests, in the *Geological Magazine*, that the conditions described by Professor Prestwich must give rise to the "water hammer" action familiar to engineers. Water hammer action manifests itself where steam has to be conveyed to considerable distances from its source without any return communication or easy vent. It occurs in this way: The steam, on being turned into the cold pipes, is quickly condensed, and in a short time a quantity of water is formed. The steam condensing most quickly at the end furthest from the inlet, there is there formed a partial vacuum. The steam, rushing forward in consequence, gathers up the water into a plug, which fills the sectional area of the pipe, and forms, indeed, a water piston. This water piston is dashed by the force of the steam against the end of the pipe, producing a severe shock, accompanied by a loud report; and then follows, by natural sequence, a rebound, which must be a rebound of a compound character, made up in part of the rebound of the steam, in part of the rebound of the water, and in part of the effort of the water to regain its level by gravity. The first two are probably of momentary existence, but the last takes time, and proceeds with a measured swing like a mighty pendulum. When the force of the return wave is spent, and the steam again gets the advantage, condensation having in the meantime been going on behind the return wave, this piston of water advances a second time, and is dashed with increased fury against the obstruction in the pipe. This action in a few strokes arrives at its maximum, and thence, if the pipe has been able to withstand the shocks, gradually diminishes and dies away. There are two operations at work affecting its destiny: The quantity of water set in motion is increasing, tending to increase the shock, and the temperature of the pipe is heightening, tending to diminish the shock by reducing the difference of pressure between the spaces before and behind the water plug. The latter is by far the more potent agent, and quickly reduces the water hammer action to nothing. Now the essentials to this kind of action are: 1. A length of passage confined at its extremity. 2. A fluid. 3. A condensable vapor. 4. A difference of temperature at the two extremities of the passage. 5. The initial action, which is merely the introduction of the condensable vapor into the colder end of the passage from the hotter, so that it may be under conditions producing condensation, and thus commence the water hammer action. That this kind of action, owing largely to the very low compressibility of water, is capable of producing very severe shocks, even when the essential factors are of comparatively low value, is seen from the fact that stout iron pipes of only a few inches in diameter are often burst into fragments by it, even when the difference of pressure developed cannot be more than about 50 pounds per square inch, and where the length of pipe is not many yards. Given, therefore, subterranean reservoirs, as Professor Prestwich supposes, we have only to assume a communication formed between these two reservoirs by a fissure, and we shall have the conditions favorable for the water hammer action on such a gigantic scale as appears competent to account for the phenomena of earthquakes and volcanoes. Immediately a fissure is formed connecting the reservoirs of water nearer the surface and at comparatively low temperature with the more deep-seated reservoirs of molten rock.

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steam is formed, which, passing along the fissure, becomes condensed, difference of pressure is set up, the water and molten rock form a fluid piston or plug, and shocks proportionate to the difference of pressure, the length and sectional area of the passage, and to the quantity of matter set in motion, are thence inevitable.

If, when this action arrives at its maximum, the water cavity is incapable of sustaining the shock, and gives way, its broken walls are thrown out as dust and ash, the whole body of the water, which had become superheated, bursts into steam, and the molten rock is poured out as lava.

Dangerous Properties of Dusts.

Professor Abel, F.R.S., lately delivered a lecture at the Royal Institution on "Some of the Dangerous Properties of Dusts," of which a short abstract is here given:

The liability to the development of fire or of heat sufficient to char or inflame portions of flour by the stoppage of the feed of grain, appears from all accounts to be extremely difficult to guard against, and to have been the cause of many serious calamities ever since the Tradeston explosion, examples of which are the great explosion of six mills at Minnesota in 1878, when eighteen lives were lost and much property was destroyed; and the fatal and destructive explosion of a flour mill at Macclesfield in September last, which has been made the subject of a report to the Home Office by Mr. Richards, of the Board of Trade. It appears to be the opinion of experienced men in the trade that although special attention to the feed arrangements may reduce the number of explosions, this cause of accident is almost impossible to guard against; while, on the other hand, many fires or explosions ascribed to it have been due to the employment of naked lights in mills near localities where the air is laden with flour dust. Considering that flour and rice mill owners have to bear the burden of very heavy rates of insurance, it is to their interest, independently of their responsibilities as the guardians of the lives of their workmen, to adopt most stringent regulations and efficient precautionary measures for abolishing this source of danger, and to devote their energies to the application of improved arrangements for reducing the quantity of dust which passes away from the millstones, and from other parts of a flour mill.

The important part played by coal dust, which exists in greater or less abundance in all coal mines, in aggravating and extending the injurious effects of fire damp explosions, was originally pointed out early in 1845 by Faraday and Lyell, when they reported to the Home Secretary the result of their inquiry into an explosion which occurred at Haswell Collieries in September, 1844.

Ten years after the publication of Faraday and Lyell's report, M. De Souich, an eminent French mining engineer, published as original some very similar observation, made by him on examining the effects of a coal mine explosion at Firminy; he noticed, moreover, that men near the pit's mouth had received burns, while others who were in the workings near the seat of the explosion, but out of the main air current, escaped unhurt, and he ascribed this to the action of coal dust in carrying flame along the principal air-way. Later on, De Souich extended his inquiries into the part played by coal dust in explosions, and the subject was afterward pursued, from time to time, in France, by Verpilleux and other authorities in mining engineering, and especially by M. Vital, in 1875, when an explosion occurred at Campagnac, the destructive effects of which appeared to him in a great measure ascribable to coal dust. Vital made experiments upon a very small scale, for the purpose of ascertaining whether flame, such as that projected into the air of a mine by the firing of a charge of powder, in a very strong blast hole, was increased in size by the presence of suspended coal dust; and soon afterward Mr. W. Galloway commenced a series of experiments of similar nature, but upon a larger scale, which he has continued from time to time up to the present date; while Messrs. Marreco and Morison, in connection with the North of England Institute of Mining Engineers, and a committee of the Chesterfield and Derby Institute of Engineers, have also contributed valuable experimental data bearing upon the influence exerted by coal dust, not merely in increasing the magnitude of explosions resulting from the ignition of mixtures of fire-damp and air, but also in propagating or even actually developing explosions, when only small quantities of fire damp are present in the air of a mine, or where fire damp is believed to be entirely absent. The conclusion to which Mr. Galloway was led by his earlier experiments was to the effect that coal dust, when thickly suspended in air, had not the power to originate an explosion, or to carry on to any distance the flame from a blown-out shot, but that the presence in the air of such small quantities of fire damp (2 per cent and under) as an experienced miner would fail to detect by means of his Davy lamp, with which the gas is generally searched for, would impart to a mixture of coal-dust and air the property of burning and carrying flame. But he held the view, at the same time, that a fire-damp explosion in one part of a mine might be propagated to some extent by coal dust raised by the effects of the explosion in parts of the mine where no fire damp existed. Marreco, on the other hand, considered that the results of certain experiments made in the entire absence of coal dust, by firing shots in air, traveling at some considerable velocity, and containing coal dust thickly suspended in it, warranted the conclusion that coal dust also might, under certain conditions, originate an explosion as well as carry it on to some considerable extent. The results obtained by the corresponding experiments of the Chesterfield Committee appear to support this view, and Mr. Galloway has also, by his later experimental results, been led to the same conclusion, and considers that the results of his examination into the effects produced by some of the most serious of recent coal mine explosions (at Penygraig, Risca, and Seaham) demonstrate that those explosions were chiefly, if not entirely, attributable to coal dust.

The strong impression entertained by many, during the inquiry into the great explosion at Seaham Collieries, in September, 1880, that coal dust might have had much to do with the accident, and that the explosion was possibly even entirely due to the ignition of coal dust by a blown-out shot in the absence of any fire damp, led to Mr. Abel being requested by the Home Secretary to make experiments with samples of dust collected in the mine, and to an extension of these experiments to dust collected from collieries in different parts of the kingdom where explosions had occurred.

The results of experiments conducted with great care and on an extensive scale at a colliery in Lancashire, where a constant supply of fire damp was brought to the pit's mouth from a so-called blower, confirmed the fact demonstrated by M. Vital and Mr. Galloway, that the propagation of fire by coal dust, when thickly suspended in air, is established or greatly promoted by the existence, in the air, of a proportion of fire damp, which may be so small as to escape detection by the means ordinarily employed (such, for example, as exists in the return air of a well ventilated mine).

It was also established that a mixture of fire damp and air approaching in proportions those required to be explosive, would be ignited by a flame if only a small proportion of dust were floating in it. Further, it was demonstrated that, although those dusts which were richest in inflammable matter, and most finely divided, were the most prone to inflame and to carry flame, in the presence of small quantities of fire damp, some dusts which contain coal only in comparatively small proportions were as sensitive as others much richer in inflammable matter; and that even perfectly non-combustible dusts possessed the property of establishing the ignition of air and gas mixtures which, in the absence of dust, were not ignited by a naked flame. The action of non-combustible dusts appeared to be due to physical peculiarities of the finely divided matter, and to be perhaps analogous to the contact action so well known to be possessed by platinum and some other bodies, whereby these bring about the rapid oxidation of gases which, in their absence, may exist intact in admixture with oxygen or air.

Although it may be very doubtful whether coal dust, in the complete absence of fire damp, can be credited with the production of extensive explosions, as has been recently maintained by some, there can be no question that, in the presence of only very small quantities of fire damp, it may establish and propagate violent explosions; and that, in the case of a fire damp explosion, the dust not only, in most instances, greatly aggravates the burning action, and increases the amount of after damp, but that it may also, by being raised and swept along by the blast of an explosion, carry the fire into workings where no fire damp exists, and thus add considerably to the magnitude of the disaster. The supposition that extensive coal mine explosions may be produced by coal dust alone, in the complete absence of gas, necessitates the fulfillment of conditions which cannot be at any rate very exceptional, but its acceptance is unnecessary to add to the formidable character of coal dust as an agent of destruction in mines. The possibility of dealing with the dangerous dust in mines should, therefore, be as much an object of earnest work as has been the improvement of ventilating arrangements in mines.

The actual removal of dust accumulations being in most instances impracticable, the laying of the dust by an efficient system of watering the mine ways is a matter deserving serious attention. Although in some instances such a measure is not readily applicable without injury to the workings, it has been already proved in some districts to be unobjectionable and susceptible of very beneficial application. The employment of deliquescent substances (calcium chloride, sea salt, etc.) in conjunction with watering, has also been advocated and tried to some extent with success.

Meat Preservation.

The second part of a demonstration of a new method (under Jones's patent) of meat preservation was given recently at the Cannon Street Hotel, when the efficacy of the process was proved in a practical way by the serving for luncheon of mutton killed on March 6, or thirty-nine days before. The carcasses from which the joints served up were cut had been kept in a butcher's shop at a temperature varying between 50° and 60° Fah. Mr. Hardwicke, who presided, remarked, on sitting down to lunch, that the meat would be found to have been prepared in the simplest way, in order that the flavor and quality of the flesh might be better appreciated. The experiment showed that the mutton, of which boiled and roasted joints were served, was perfectly free from any taint or taste of the antiseptic chemical used to preserve it, and that the meat retained its natural juiciness and flavor. It was, moreover, very tender. The process differs from other appliances of antiseptics to the preservation of meat in one important feature—the preservative substance (boracic acid) is injected into a vein while the creature, though stunned by a blow on the head, is still alive, and the action of the heart is relied upon to pump it through every part of the body into which the vascular system ramifies. With regard to a question which has been raised as to the innocency of boracic acid as an antiseptic, Colonel Harger quoted Dr. F. P. Atkinson, who says: "Considering the well known properties of boracic acid, it is exceedingly curious how little it has been administered as an internal remedy. Its effect in diphtheria, both locally and internally, is very marked." This he proceeds to show by reference to observations of Dr. Cossar Ewart and Dr. Malcolm Simpson, and subsequently states that "a dose is 5 to 15 grains. It has one particular recommendation, and that is its tastelessness." In the room was shown the carcass of a sheep killed on the 6th of March last, still in perfect condition, and to preserve which 5 ounces of boracic acid were used, the whole carcass weighing 74 pounds. The two hind-quarters of another sheep, killed on the 20th of February, or 54 days ago, were also shown. No difference was perceptible between the condition of one or the other. To preserve the latter, which weighed 89 pounds, 6 ounces of boracic acid had been used. As, however, a large proportion of the solution injected probably flows away with the blood when the creature is struck by the butcher, two minutes after the injection of the boracic acid, it is impossible in the absence of any *data* from careful quantitative analysis to calculate the quantity remaining in the fiber of, say, half a pound of meat, before cooking. But small as this quantity must be, there can be no doubt that, introduced in this way into the living organism, it suffices to preserve not only the carcass, but also the heart, liver, kidneys, and other organs of the body. The economical advantages of a method which, if used in the *abattoirs* of Sydney or Melbourne, would only render it necessary to reduce the temperature in the storing rooms during the voyage to 50° Fah., instead of 30° Fah., must evidently be considerable. The loss of weight in a sheep thus preserved and kept for one month has been found to be about 5 per cent.—*London Times.*

Canadian Experience with Cattle.

The superintendent of model farm at Guelph, Canada, gives as below the results of some experiments made there in cattle breeding:

1. A steady frosty winter is better than an open one in feeding cattle.

2. An average two or three year old steer will eat its own weight of different materials in two weeks.

3. Two or three year old cattle will add one-third of a pound more per day to their weight upon prepared hay and roots than upon the same materials unprepared.

4. It is 30 per cent more profitable to premature and dispose of fattening cattle at two years old than to keep them up to three years.

5. There is no loss in feeding a cattle beast well upon a variety of materials for the sake of manure alone.

6. Farmyard manure from well fed cattle three years old is worth an average of $2.30 per ton.

7. A three-year old cattle beast, well fed, will give at least one ton of manure every month of winter.

8. No cattle beast whatever will pay for the direct increase to its weight from the consumption of any kind or quantity of food.

9. On an average it costs twelve cents for every additional pound of flesh added to the weight of a two or three year old fattening steer.

10. In Canada the market value of store cattle can be increased 36 per cent during six months of finishing by good feeding.

11. In order to secure a safe profit, no store cattle beast, well done to, can be sold at less than four and one-half cents per pound (live weight).

12. In the fattening of wethers, to finish as shearings, the Cotswold and Leicester grades can be made up to 200 pounds, the Oxford Down 180 pounds, and the South Down (grade) 160 pounds each, live weight.

13. A cow wintered upon two tons and a half of hay will produce not far from five tons of manure, provided that she be well littered and none of the excrements be wasted.

The New Krupp Torpedo Gun.

Herr Krupp has recently conducted a series of experiments with a new kind of gun and shell. The gun is on the muzzle pivoting system, and the shell has been specially designed for torpedo effect, that is, to burst on penetration of armored ships with a result similar to the explosion of a torpedo. Herr Krupp's recent experiments at Meppen were considered to be highly satisfactory, and quite sufficient to justify the great German manufacturer of weapons in taking immediate measures for the production of larger guns and shells than those tried. The gun experimented with was of twenty-one centimeter caliber, with a long shell having a tremendous bursting charge, so arranged that the shell should explode only after penetrating some distance into the armor plating. The gun's muzzle pivot is carried down into a socket fixed in the hold of the vessel in such a way as to prevent the slightest recoil even with the heaviest charge. Herr Krupp's gun was worked during the trials with great ease and certainty of aim, and obtained for the shell a very high velocity. This description of weapon has been designed for gunboats built to carry guns up to forty centimeters. These gunboats are to be of light draught, high rate of speed, and exceedingly handy. In fact, two or even three of such armed boats would be very ugly customers for a first-class armored ship to cope with, owing to their rapid power of maneuvering, and their small size rendering them difficult to hit. Their cost would be but an eighth or a tenth of a first-class iron clad.

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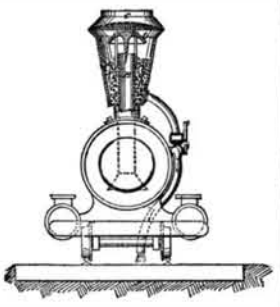
ENGINEERING INVENTIONS.

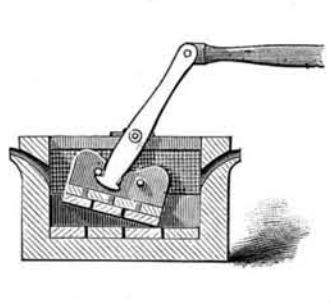
Spark Extinguishing and Discharging Device.

Mr. William K. Schermerhorn, of Schenectady, Schenectady county, N. Y., has patented a spark extinguishing and discharging device for locomotives, which insures freedom of draught by avoiding choking the netting of the smoke stack, and does away with the risk of fire in combustible materials or structures along the line of the road. It also provides for the discharge, in an extinguished condition and at convenient times, of the cinders and other heated particles carried up by the blast into the smoke stack, and this without annoyance to the passengers of a train. The devices are shown in the accompanying engraving. The smoke stack has a discharge pipe leading from the stack down to the track or any suitable receiver, and provided with duplicate valves, one of which is to allow the escape of cinders and other matter deposited in the stack down the discharge pipe, and the other valve provides for opening a jet attachment or injector connected with the boiler, to sprinkle or extinguish by steam or water taken from the boiler the heated particles escaping through the discharge pipe, and also to create a discharging suction within the pipe. These valves are under the control of the engineer, and the one which provides for the discharge of steam is preferably the surface blow-off cock, and when the valve is opened it acts both to clean the surface of the water in the boiler and to perform its duty in connection with the spark extinguishing device. The sparks may be discharged as fast as they accumulate, or be allowed to collect and be discharged at intervals, when and wherever it may be most convenient.



Improvement in Ore Crushers.

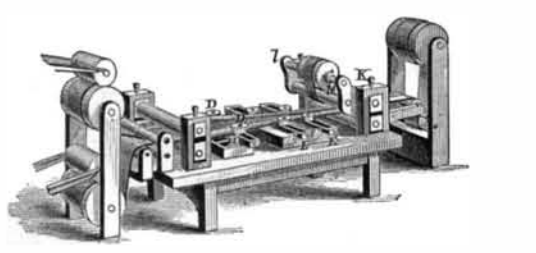
We give herewith an engraving that illustrates an ore reducing and pulverizing machine, in which the ore is subjected to both a stamping and rubbing action. This machine is patented by Mr. Angus N. Cameron, of Greenville, Plumas Co., Cal. A is an ore box, and the stamp head or blocks and rocking lever, which is formed at its lower end with projections, is pivoted upon the edge of the ore box. The bottom of the ore box and the end of the stamp head are faced with removable hardened plates, and the stamp head is also formed with cross rods, *c c*. The relation of the projections on the lower end of the rocking lever with the cross pieces of the stamp head is such that upon imparting motion to the rocking lever the projections will engage with the cross pieces and move the stamp head from end to end of the ore box, and alternately raise and let fall the ends of the block, thus causing the block to have both a stamping and a grinding or rubbing action. At the point where the cross rods come in contact with the vertical sides of the rocking lever the lever is provided with spring-supported buffer plates, to ease and deaden the concussion when the lever and cross pieces come in contact. This double action of the stamp head is of great advantage, as the ore is pulverized more thoroughly and put in a better condition for subsequent treatment than by the ordinary stamp mill, and it is also more rapid in its action than mills that work solely upon the attrition principle.



MECHANICAL INVENTIONS.

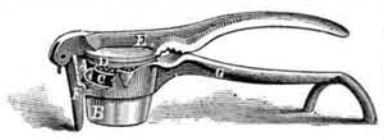
Machine for Making Rubber Belting.

A simple and effective machine for folding the rubber covering over the webbing forming the central portion of a rubber belt, has recently been patented by Mr. Joseph T. Ridgeway, of Trenton, N. J. The rubber covering and the webbing are taken from rolls at the rear of the machine, and drawn between horizontal rollers, bringing them into close contact with each other. The covering is wider than the webbing, and after passing through the horizontal rollers its edges are turned up, and it is gradually turned and folded upon the webbing by three pairs of flanged vertical rollers, made adjustable to suit belting of different widths. A cover narrower than the belt is supplied from a roll near the front end of the machine. It covers the gap between the overlapping edges of the wider cover. The webbing with its covering receives a final pressure between horizontal rolls near the front of the machine. The belting passes from the machine through a box of powdered soapstone, and is wound upon a roll preparatory to vulcanizing.



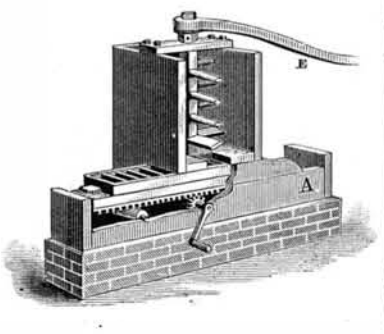
A Novel Fruit Squeezer.

Mr. Wm. B. Dean, of New York city, is the patentee of a fruit squeezer which involves new and useful features. The accompanying engraving is a side elevation, partly in section, of the improved device, which consists of the holding frame, A, formed of the ring, F, in which rests the juice cup, B, the bottom juice extracting strainer, C, and the top juice extracting die, D, connected with the lever, E. The handle, G, is constructed so as to form an easy grasp for the hand, and reaches back and is connected with a standard which supports the handle so as to admit the fingers underneath. It is evident that by constructing the frame in this manner, with the feet attached to the handle, G, the device may be placed upon a table and a lever force brought to bear, in which the weight of the body is made to very materially assist in squeezing. The feet elevate the handle so that the hand has a firm grasp and combines compression with the pressure. The top die, D, has a flat corrugated surface, the corrugations preventing the lemon or fruit from slipping backward in squeezing. The bottom die is made in one piece about three-quarters of an inch in height with slanted or perpendicular sides, a shoulder being formed on the bottom to rest on the juice cup. The top is flat, with the outer edge elevated about one-eighth of an inch, this elevation being tapered to a thin edge at the top, forming an annular cutting edge. The bottom has holes cut in the edge to allow the juice to escape. This superior construction requires less power to squeeze the lemon, as it avoids the resisting force of the rind. The lemon, being cut in halves, is placed, cut side down, on top of the lower die. When pressure is exerted the rind passes down outside of the die, while the pulp, being stripped from the rind by the annular cutting edge, is forced upward into the top of the rind, the pulp being unable to escape, and the juice escapes only through the perforations of the die into the cup below. By this device a pure juice is produced free from rind oil, as no pressure is brought to bear upon the cut edge of the lemon.



Brick Machine.

A brick machine constructed and arranged so that one set of filled moulds may be removed and replaced by empty moulds, while another set is being filled, has been recently patented by Mr. Milton Wright, of Fort Valley, Houston county, Ga., and is shown in the annexed engraving. A is the base frame of the machine, and to the top of the middle part of it is attached the hopper, within which is placed a vertical shaft which revolves in bearings in its center, the upper end of the shaft revolving in bearings in a cross bar attached to the top of the hopper. This shaft is revolved by such power as is convenient, generally horse power, and to it are attached a number of radial arms to mix the clay and keep it thoroughly stirred. To the lower part of the shaft are secured four radial paddles, which are set with a lateral inclination and with their lower edges close to the bottom of the hopper so that the paddles will press the clay downward through an opening in the hopper bottom into moulds placed below it. The moulds are placed upon the end parts of a sliding platform, the upper surface of the middle of which is flush with the top of the moulds, so as to close the bottom of the hopper when the moulds are withdrawn. The platform rests on rollers that have annular grooves to receive a rack bar attached to the lower side of the platform, the rollers and rack bar serving as guides to carry the platform in a straight line. The teeth of the rack bar mesh into the teeth of a gear wheel, attached to a shaft which revolves in proper bearings in the base frame, and to the ends of the shaft is attached a crank. When the crank is turned the platform is moved a sufficient distance to remove one set of moulds from beneath the opening and bring the other set beneath it, so that one may be removed while the other is filled.



Friction Clutch.

An ingenious friction clutch, that is formed of a band or wire coiled around the shaft, and provided with a projecting end for the application of power, whereby the coil will be tightened to grasp and rotate the shaft when the end of the projection of the wire is rotated in one direction, and will be loosened so as to slip over the shaft when the projection is rotated in the reverse direction, is shown in the annexed engraving. A rod or wire is coiled a number of times around a shaft, but is not attached to the shaft. The inner end of the rod rests against the shaft, and the outer end projects from the shaft a distance equal to the desired length of the lever of the clutch. The outer end of this wire is provided with a loop for pivoting a connecting rod or wire to this end of the coil. If the end is turned in the direction of the arrow, the coil will be tightened on the shaft and will grasp it with sufficient power to rotate it, but if the end of the wire is turned in the reverse direction, the coil will be loosened and slip on the shaft, which will remain stationary. The number of the coils of wire can be varied as may be required, the number to be increased with the resistance offered by the shaft. The clutch is patented by Mr. Analdo M. English, of Providence, R. I.

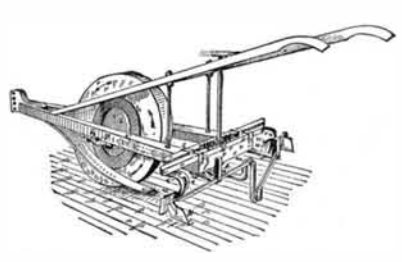
Portable Door Fastener.

A convenient and useful invention for travelers' use is a pocket device for securing doors, that can be attached to any door rapidly and conveniently without any implements, that is patented by Mr. Charles A. Crongeyer, of Detroit, Wayne county, Mich. A metal strip is provided at one end with a flat hook, and a rod, C, is pivoted to its opposite end, and the outer end of the rod is screw threaded. A U-shaped piece, whose shanks are of unequal length, has an aperture in its curved middle part through which the rod passes in such a manner that the ends of the shanks of the U-shaped piece project toward the hooked end of the strip. This piece is secured in any desired position on the rod by a milled nut screwed on the outer end of the rod. The ends of the shanks have a flat smooth surface to rest against the surface of the door and frame. The short shank is adapted to rest against a moulding or casing, and is provided with a swinging leg of such length that when it is swung outward its end will be flush with the end of the long shank. When used, the hook of the metal strip is placed against the jamb of the door, and the U-shaped piece is turned in such a manner as to permit the closing of the door, and when the door is closed the hook is forced into the wood of the jamb. The piece is then turned so that the long shank will rest against the surface of the door. The device does not mar the door and keeps it locked perfectly, and is applicable to doors of any thickness, and with little or no trouble It can be compactly folded, and is especially adapted for travelers.

AGRICULTURAL INVENTIONS.

Implement for Siding and Thinning Cotton.

A new and useful device for thinning and siding cotton plants has been recently patented by Messrs. Charles P. Dickert and Emanuel McD. Heller, both of Walton, Newberry Co., S. C. The device is shown in the annexed cut, and is an implement that scrapes both sides of one or two cotton rows at a time, and also thins out the cotton plants between the plants to be left standing. The scraper can be laterally adjusted while the implement is in motion to adapt them to conform to the irregularities in width between the cotton rows. A rigid triangular frame is provided with a clevis at its forward end, and handles having their forward ends firmly secured to the frame and their rear ends firmly upsported by rods. A driving andsupporting wheel, provided with an axle, is arranged between the sides of the triangular frame, and has its bearings secured in boxes secured to the lower faces of its sides. A shaft provided with a bevel pinion on its forward end that engages with a bevel gear on the driving wheel is supported at its rear end in a box secured to the under side of a transverse bar of the frame. This end of the shaft is provided with double cranks, to which are pivoted the ends of the handles of two hoes, which project on opposite sides of the machine, where they pass through suitable guides. By this construction, when the machine moves forward, the shaft and double cranks are revolved, and the hoes operated, and the plants between those to be left are thinned out. Two parallel rack bars rest on the upper side of the frame near its rear end, and adapted to slide laterally. To one of the ends of each rack bar is secured a scraper, that straddles the plants in a row and scrapes its sides. Between and engaging with both rack bars is a cog wheel, that is attached to an upright shaft that is provided with a hand wheel at its upper end, and by which the plowman can adjust laterally the scrapers to conform to the irregularities of the rows.



Combined Hand Seed Planter and Fertilizer.

A seed planter that has combined with it a fertilizer distributer, and is simple in construction, cheaper, lighter, and more durable than those heretofore made, has been patented by Mr. Owen Stoddard, of Busti, Chautauqua Co., N. Y., and is shown in the annexed engraving. In the device two boxes

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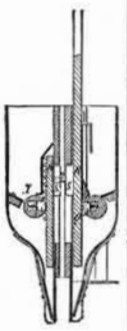
are provided, one to receive seed and the other a fine fertilizer. The inner and side walls of the boxes are vertical, and the outer are inclined inward and downward until their lower ends nearly meet the plates, C, attached to the lower parts of the inner walls, and project downward to enter the soil. The side edges of these plates are bent outward at right angles, and form guides to plates whose lower ends rest against the outer sides of the plates, C, and are secured at their upper parts by springs that are attached to the outer walls of the boxes. These plates meet each other at an angle, so that they will enter the soil readily, and the depth to which they enter the soil is regulated by a gauge plate that is so attached to the side of the box that it may be readily raised and lowered. To the side walls of each box is pivoted a cylinder having a deep recess on its side, and so constructed that the depth of the recess may be regulated, and also the amount of the seed and fertilizer.

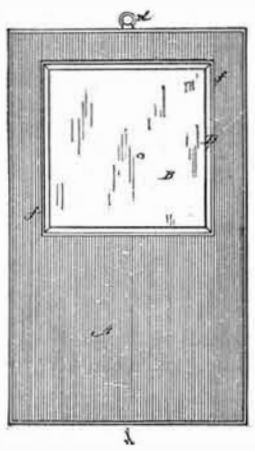


These cylinders have gear wheels that are operated by rack bars that are attached to a slide that moves up and down on the inner walls of the boxes. As the slides move down their lower ends press back the plates at the bottom of the plates, C, opening channels in the soil and allowing the seed and fertilizer to drop in, and also revolving the cylinders for dropping the seed.

MISCELLANEOUS INVENTIONS.

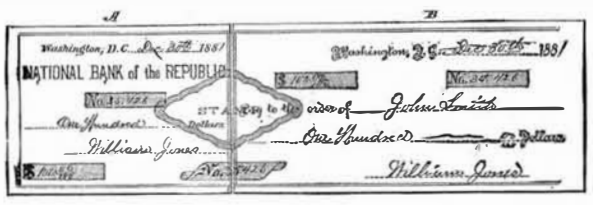
Match Igniters.

A new match igniter, that can be seen and easily found in the dark, has lately been patented by Mr. James R. Donnelly, of New York city, and is shown in the annexed engraving. A is the match igniting surface, which has a sanded surface, and B is a spot or plate which is made luminous by a coating of some luminiferous substance or mixture, such as sulphide of calcium and oil, or any phosphorescent substance may be used. As shown in the engraving the luminous substance is placed upon the back of a plate of glass which is set in the main body of the device, the body being straw board or other material, and upon which the sanded surface is placed. The back of the coating and the plate of glass are protected and held in place in the opening by a backing of cloth or other suitable material, secured upon the back of the base. The igniter is provided with a ring attached to its upper end, so that it can be hung upon the wall or gas fixture, and can always be found in the dark, making the destructive practice of scratching matches upon the wall or furniture entirely inexcusable.



A Security Bank Check.

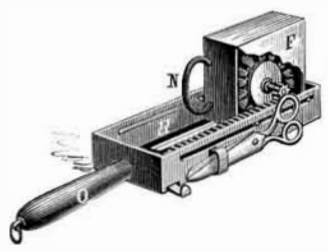
A novel and ingenious bank check has recently been patented by Mr. Edwin S. Loomis, of Washington, D. C. It is of such form as to prevent forgery and the raising of checks, and also prevent the collection of checks by fraudulent means. The improvement is shown in the accompanying engraving, and consists of check made of two separable parts, both of which are signed by the drawer, and one of which contains the name of the bank and the amount and number of the check, and constitutes a bank notice; the other contains the name of the party to whom the check is made payable, and the amount, without the name of the bank, and constitutes the pay order. In the engraving, A is the bank, and B the pay order. The pay order is given to the party in whose favor it is drawn, with verbal or written instructions as to what bank it is on, and the bank



notice is to be sent to the bank. The bank is thus enabled to compare and verify the pay order when presented by the bank notice. Neither of these parts is of any value by itself. The bank notice and pay order taken together constitute a "security check," and the line of division between the two is preferably made to pass through the revenue stamp, so that the act of severing the parts cancels the stamp. The invention is also applicable to bills of exchange, drafts, or any equivalent writing by which money is conveyed. For sending money by mail, complete security may be had by separating the bank notice from the pay order, and sending them one to the bank and the other to the payee. When the check is payable to order, the indorsement may be made on both notice and order, giving the bank a signature with which to compare the name on the pay order, and by sending the notice to the bank there is no necessity of having the payee identified.

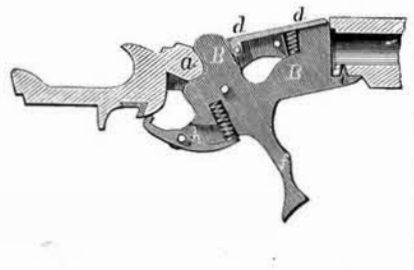
Novel Wick Trimmer.

Mr. William Charles Seaton, of Quebec, province of Quebec, Canada, has secured letters patent in the United States for a novel and useful device for doing the unpleasant part of the work of caring for a lamp, viz., cleaning and trimming the wick. The inventor provides a rotary brush wheel, A, contained in a box, F, that slides in a frame, H, which has a longitudinal slot in the bottom. Through this slot the carbonized end of the wick is passed, and is held by suitable holders, so that the rotating brush wheel can brush off the carbonized parts. The brush wheel has a pinion on its shaft that engages with a rack on the frame of device. Upon the frame are also placed on each side of its longitudinal slot the holders referred to above, to which are attached devices for giving them motion for holding and releasing the wick. A box, F, containing the brushing wheel, and in whose sides the wheel is journaled, is arranged to slide longitudinally on the frame, H. The ends of the box are provided at the bottom with recesses for the passage of the wick. It is also provided with a handle, N, which extends inside the box and is attached to one end of a spiral spring, the other end of which is attached to the frame, H. When the wick is passed into the longitudinal slot of the frame, and is grasped firmly by the holders, the box, F, is drawn in the direction of the handle, O, by passing the finger through the handle, N, and is then released, the coil spring pulling it back. This movement is repeated as often as is necessary to cleanse the wick. By this movement of the box the brush wheel is rotated and the carbonized parts of the wick are removed without soiling the hands of the operator or the lamp.



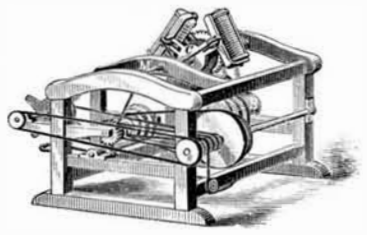
Breech-Loading Firearm.

Mr. Alexandre Picard, of Montaign, Jura, France, has patented an improved breech-loading firearm. This invention belongs to that class of firearms in which the bore is closed when the cartridge is in the barrel by means of a rocking block which is brought in position before the explosion of the cartridge. In the accompanying engraving, A is the breech of the gun, having a rear extension provided with a lengthened wire slot, in which is placed the rocking block, B, that rotates in its movement upon a rib, *a*. The block has upon its upper face a recess which allows the cartridge to pass into the barrel. In this recess is fitted a small plate, *d*, mounted on a pivot pin, *d'*. The free end of the plate is pressed upward by a spring, and by this the plate is caused to project above the upper face of the block, preventing the cartridge placed in the barrel from dropping back when the breech is open. A lever, *f*, is formed solid with the block, B, and the latter has in its rear extremity a hole that receives a screw on which the catch, *h*, is pivoted. A spring forces the front end of the catch downward, and the rear end has a hook that is adapted to engage a corresponding hook in the breech. The conical hammer, *l*, is made in one piece with the block, so that if the block is pushed suddenly upward the hammer will strike the cartridge through a hole made in the barrel. A forked spring, *n*, is fixed below the barrel by a screw, and its free ends rest on pins, *m*, projecting from both sides of the block, B. When the mechanism is in its firing position, and the trigger, *o*, is pressed, the catch, *h*, is released from its hook and the rocking block is thrown suddenly upward by the action of the forked spring, so that the cartridge is struck by the hammer through the hole in the barrel and exploded. Extractors are placed on both sides of the barrels, and by proper devices, when the rocking block, B, is thrown quickly down, the cartridge shell is drawn from the gun. After the shell is drawn the spring of the catch, *h*, brings the block, B, back to its firing position.



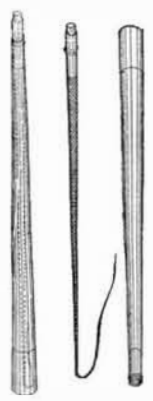
Rope Machine.

An improved machine, by which the long rope walks and buildings heretofore required for making ropes are dispensed with, and that makes rope more rapidly and of a better quality than can be made by ordinary machines, is shown in the annexed engraving, and is patented by Mr. John Harris, of Columbus, Platte county, Neb. A, A, are the end pieces of the frame of the machine, that are tied together by longitudinal rails, so as to support the mechanism. The driving shaft, B, is sustained in suitable boxes in the lower part of the frame, and carries the pulleys, *b c*, the latter being a grooved cone. The laying shaft, C, is sustained in boxes at the top of the frame and driven from the shaft, B, by a belt from pulley, *b*, and is fitted with carriers which consist of three armed spiders that carry the fliers and spools. The fliers are rectangular frames of metal sustained at their mid length on the spider arms by gudgeons. Lengthwise of the fliers are fixed spindles that sustain the spools, and springs fixed on the flier and bearing on the ends of the spools with an adjustable device prevent the spools from turning too freely on their spindles. On the shaft, C, is a loose cone pulley, to which is attached a toothed wheel that meshes into pinions on the inner gudgeons of the fliers, the loose cone pulley being driven by a belt from the cone pulley on the shaft, B. The cone pulley being driven at a greater speed than the shaft, C, causes the fliers mounted on the arms on this shaft to revolve in an opposite direction. By means of suitable guides the strands are led from the bobbins through tension devices to the journal, *m*, within which they are laid. By means of a suitable take-up mechanism, shown in the engraving, the rope is properly stretched and pressed. With this machine rope making may be carried on in small buildings and a less number of hands.



Combined Whip and Cane.

A whip that can be converted into a cane, so that it can be carried more conveniently when not in use as a whip, has recently been patented by Mr. Louis C. Seltzer, of Columbus, Franklin county, O., and is shown in the accompanying drawing. The whip stock, which is about the length of an ordinary walking cane, is made tapering and hollow, the longitudinal aperture being about three-eighths of an inch in diameter, and extending through the stock from the small end, which is provided with a fixed internally threaded metallic ferrule. The tapering tip, to the upper end of which the lash is fastened, is provided at its lower end with a screw fitting exactly in the ferrule on the stock, and it has an elastic button projecting from its end. The stock and tip may be made of any suitable material. If the combination is to be used as a whip, the ferrule on the tip is screwed to the stock ferrule, and the stock and tip form one continuous piece having a lash at its upper end. When it is used as a cane the stock and tip are separated, and the tip is placed in the aperture in the stock, the small end foremost, and the ferrules are screwed together, the elastic button projecting from the end, and when the cane is used comes in contact with the ground and protects the ferrules. As whips left in carriages are very apt to be stolen, and as it is very inconvenient to carry an ordinary whip, the combined whip and cane will be appreciated, as the whip is carried along conveniently.



Steam Engine.

A new steam engine, in which the use of steam is economized, and in which a constant equal pressure or strain upon the driving shaft is secured, has recently been patented by Messrs. Daniel W. Shaw and Pleasant W. Brown, both of Murfeesborough, Rutherford county, Tenn. The invention is an improvement in the class of steam engines having more than one movable piston working in the same cylinder, each of which is separately connected by the crank shaft. The cylinder of the engine has three pistons, the rod of the central piston passing through the center of the inner piston. The rods of the outer piston pass through the inner piston, and are secured thereto at equal distances from the rod of the center piston. These rods also pass through but are not attached to the central piston; and by this construction the movement of this piston is steadied, and it will be seen that the movements of the outer and inner pistons are made synchronous. When steam is admitted through the port between the central and outer pistons, they will be forced apart in opposite directions until the exhaust port allows the escape of the steam, when the steam is admitted between the central and inner pistons, and the central piston will be moved back, the central piston moving in one direction while the end pistons move in the opposite, and as the cranks of the central and end pistons are set opposite it will be seen that by the movements of the three pistons the crank shaft is at the same moment pushed, and pulled, in opposite directions, and the strain upon the crank shaft is equal in both directions.

Improvement in Liquid Waterproof Stove Polish.

A liquid waterproof stove polish has recently been patented by Mr. William Ayling, of Chicago, Ill. The object of this invention is to form a protective coating on stoves and other articles made of iron, that is brilliant, durable, and waterproof. The composition consists of crude gum, turpentine, aqua-ammonia, water, alcohol, and plumbago, in proportions as specified

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American Fruit Drier. Free Pamphlet. See ad., p. 358.

Ball's Variable Cut-off Engine. See adv., page 358.

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For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

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Cope & Maxwell M'f'g Co.'s Pump adv., page 353.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 357.

Lehigh Valley Emery and Corundum Wheels are acknowledged to be the safest, freest cutting, and most durable wheels in use. Write for prices, stating sizes you use. L. V. E. W. Co., Lehighton, Pa.

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Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 358.

Supplee Steam Engine. See adv. p. 357.

Patent Key Seat Cutter. See page 358.

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Drop Forgings. Billings & Spencer Co. See adv., p. 341.

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Steam Pumps. See adv. Smith, Vaile & Co., p. 306.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 324.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) C. H. A. asks: 1. Can a solution be made for nickel-plating brass to stand steam heat—if so, how? A. Yes; see "Nickel-Plating," in SUPPLEMENT, No. 310. 2. How large should steam and exhaust ports be in an 8 by 16 common slide valve engine? A. Steam openings ⅝ of an inch by 5 inches; exhaust 1⅛ inches by 5 inches. 3. How do you calculate the horse power of a steam engine? A. Refer to SUPPLEMENT, No. 253, for rule.

(2) B. asks: 1. I have a house heated by hot water; the radiators are of cast iron, one of them leaks through what seems to be a spongy place in the casting; the pressure does not exceed eight to ten pounds; how can I stop the oozing? A. If there is a distinct flaw or crack, it might be stopped by packing it with the iron cement described on page 2510, SUPPLEMENT, No. 158. Otherwise a new section or patch will be necessary. 2. I use rain water; had I better draw the water off, so as to empty the pipes, radiators, and boiler during the summer, or leave them full? A. Empty the pipes and radiators.

(3) J. W. writes: My friend claims that three or five hundred tons of casting was never cast in this country. I claim that there was three or five hundred tons of an anvil block cast in Pittsburg. Who is right? A. The Pittsburg anvil is supposed to be the heaviest casting made in this country. It is said 160 tons of iron was melted to pour it. What the next weight is we do not know.

[OFFICIAL.]

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May 16, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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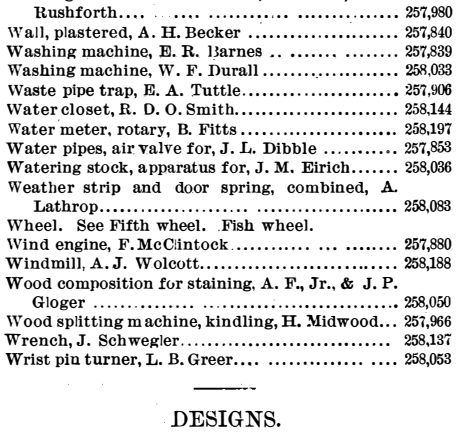

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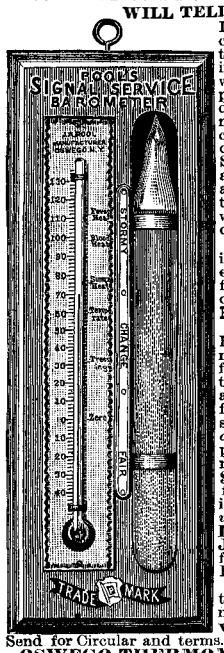

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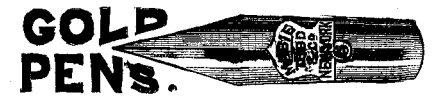

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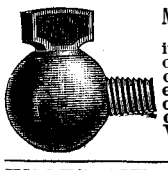
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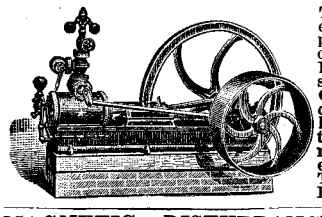
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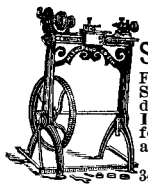
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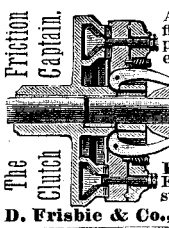

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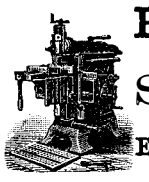
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Practical Steam Engineer's Guide

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CONTENTS.—INTRODUCTION.—Qualifications for Engineers and Philosophy of the Steam Engine. Philosophy and Operation of the Steam Engine. A Condensing Engine in Actual Work. Gain by Expanding Steam. Center of Gravity of a Body; Center of Gyration; Center of Oscillation. The Mechanical Powers; Mechanical Power; Friction. Latent Heat; Latent Heat of Steam. Specific Heat. CHAPTER I.—STANDARD AMERICAN STATIONARY ENGINES.—Oliver Evans' Non-Condensing Engine of 1800. Style of Engine which was the Standard Type in the United States for many years. Vertical Direct-Acting Engine. The Allen High-Speed Engine. Allen Engine reported upon by Committee of American Institute, N. Y. Cut-Offs. Improvements of Zachariah Allen, George H. Corliss, and N. T. Green. Babcock and Wilcox's Valve Gear; Adjustment of the Expansion in the Wright Engine. Improved Corliss Engine; Corliss Engine Valve-Motion. The Greene Engine. Woodbury, Booth & Pryor's Automatic Cut-off Engine. Double Slide Valve; Cut-off. The Governor; Gauge. Some of the Advantages of these Engines. The Wheelock Engine. Valve Gear; Cut-off. The Buckeye or Hartford Automatic Cut-off Engine. Valves and Valve Motion. Cylinder and Valves. The Governor. The Range of Adjustment; the Wright Patent Steam Engine with Automatic Cut-off Gear. Valve Motion. The Watertown Automatic Cut-off Engine. The Cut-off Valve. The Economy of a Steam Engine. Condensers; Useful Notes for Calculations Concerning Pumps. India-rubber Valves for Circulating Air Pumps; Value of High Rotative Speeds. Rule for finding the Weight of Fly Wheels. CHAPTER II.—STANDARD AMERICAN STATIONARY BOILERS.—Present form of Steam Boilers. Upright Vertical Fire Tube Boiler. Horizontal Tubular Boilers; Woodbury, Booth & Pryor's Tubular Boiler. Present Tendency in the use of Steam toward the Employment of High Pressures. Boiler of the Abendroth and Root Manufacturing Co. Babcock & Wilcox Water Tube Boiler; Construction. Erection. Operation. Advantages; Thin Heating Surface in Furnace; Joints Removed from Fire. Large Draught Area; Complete Combustion. Thorough Absorption of the Heat. Efficient Circulation of Water; Quick Steaming; Dryness of Steam. Steadiness of Water Level; Freedom for Expansion; Safety from Explosion; Durability; Least Loss of Effect from Dust; Accessibility for Cleaning. Ease for Transportation; Repairs; Capacity. The Pond & Bradford Sectional Boiler. Bates' Patent Steam Generator. Requirements of a Perfect Steam Boiler. Horse-Power of Boilers. Efficiency of the Furnace; Combustion. Experiments of Prof. Schwackhoffer with Boilers; Dr. Behr's Experiments with Boilers. Boiler Efficiency. Fuel. Incrustation and Scale. Means of Prevention. Covering Steam Pipes, etc. Abuse of Steam Boilers. Testing Boilers. Explosion of Steam Boilers. CHAPTER III.—STANDARD AMERICAN PORTABLE STEAM ENGINES AND BOILERS.—The Baxter Steam Engine. Boiler; Pump. Cylinder; Advantages claimed for this Engine. 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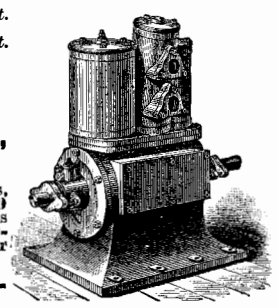

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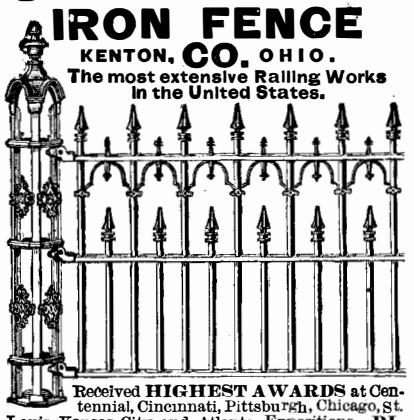

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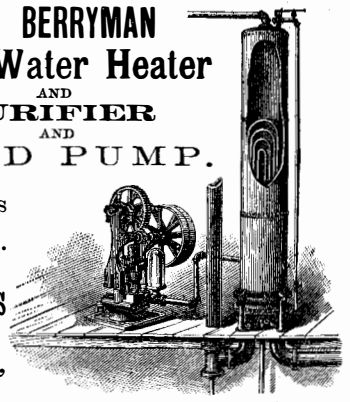

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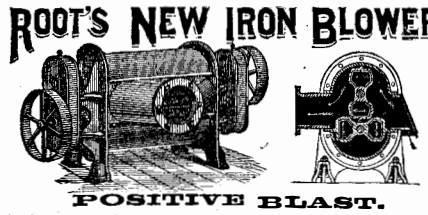

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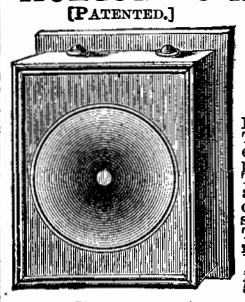

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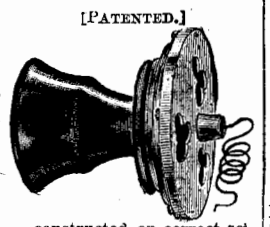

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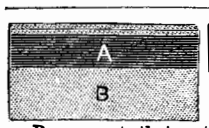

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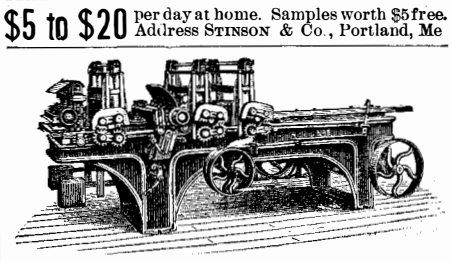

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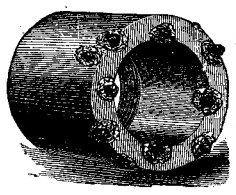

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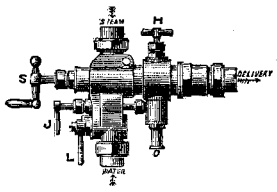

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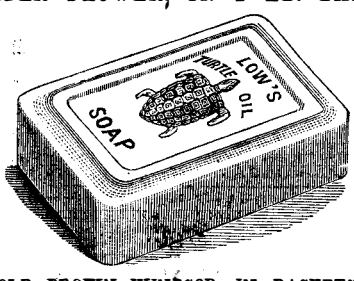

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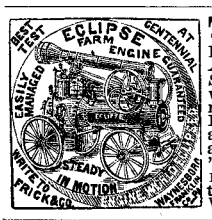

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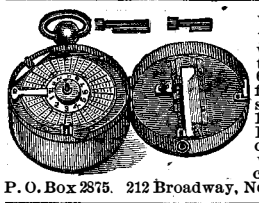

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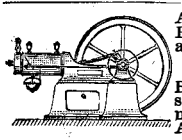

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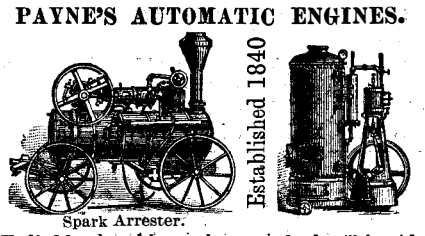

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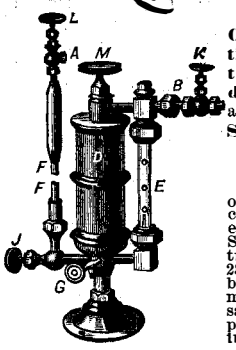

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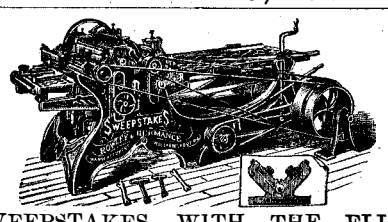

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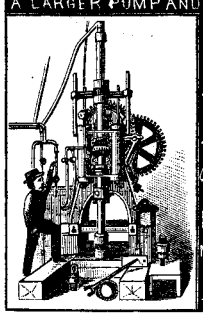

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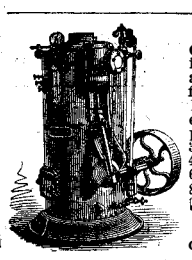

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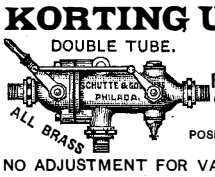

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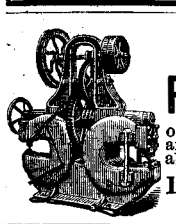

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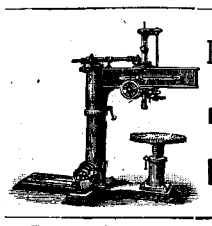

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